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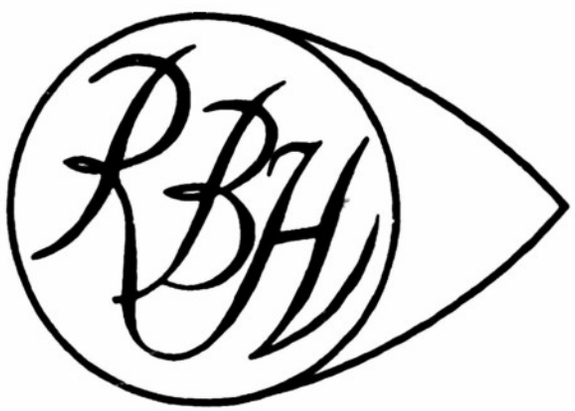
Personnel Factors in Polar Operations

ONR Contract No. Nonr-871(00)



Prepared For:

Department of the Navy
Office of Naval Research
Washington, D. C.

Prepared By:

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1 West 57 Street
New York 19, N. Y.

May 1953

RESTRICTED
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Personnel Factors in Polar Operations

ONR Contract No. Nonr-871(00)
RBH Project No. 295

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I. INTRODUCTION

A. PURPOSES OF THE PROJECT

Within recent years, increasing naval activity in polar regions has pointed up the need for systematic information concerning personnel requirements. While considerable research has been carried out to determine the effects of extreme cold on equipment and materials, too little research has been accomplished on personnel problems. As a result, there exist conflicting opinions concerning human reactions to polar conditions. For example, many observers report little or no difficulty in adjusting to these conditions. Thus, before effective personnel policies can be instituted, the existing literature and information must be sifted and integrated so that these policies can be based upon reliable information. The objectives of this study, then, are:

1. To make a survey of the existing and available literature with the general purpose of determining what unique personnel problems are created by operations under polar conditions.

2. To make recommendations for meeting such problems on the basis of the review of the literature.

3. To recommend research programs to meet such needs where the available information is inadequate.

As polar regions become increasingly important in operational plans, the need for accomplishment of the above objectives becomes even more imperative.

B. METHODS OF DATA COLLECTION

The three methods of data collection used in this study are outlined below:

1. Survey of the Literature

The main data utilized in this study were gathered through a survey of pertinent literature. A preliminary search of the literature was accomplished in New York City and Washington, D. C. From this preliminary search, bibliographies were compiled and a coding system set up so that the literature could be abstracted on McBee Keysort cards. This coding system was amplified and tentatively revised following the initial readings. A final revision was made only after additional representative source materials were surveyed. This final coding system has been applied to all the literature used in the course of this study. The use of these cards facilitated the classification

and summarization of the data. Diverse information from various sources could be rapidly integrated by "punching" the appropriate categories on the cards. Such categories as "Duty Types," "Operational Factors," "Job Factors," etc., were used. A complete listing of the various categories utilized in the coding is included in Appendix D.

The reading was then accomplished at major bibliographic reference centers, both civilian and government. While many reports and articles were reviewed, less than 200 references were considered sufficiently pertinent for inclusion in the final bibliography. These references were made up of research articles, reports of American, Canadian, and British operations in polar regions, and observations made by qualified persons familiar with problems of extreme cold.

2. Interviews With Authorities on Polar Operations

Following a survey of the major portions of the literature, the findings were summarized. Based on this summary, an interview guide was then developed (Appendix B). This guide was directed toward the clarification of problem areas in which published reports were incomplete or ambiguous. Thus, such general questions were asked as:

> Are there any particular types of jobs or billets which are most affected by polar conditions or most in need of revision?
>
> Can the usual ship's complement operate effectively in polar areas, or is special selection needed?
>
> Is arctic experience more important than knowledge of the job? How much special training is needed on the average — to produce acceptable work performance in the Arctic? Will this vary with the type of job?

The interviews were usually conducted on an individual basis; however, in some instances, group interviews were held. These were instituted when it was felt that more information could be obtained by having experts in the same area mutually exchange their points of view. Using this interview guide, 53 individuals with polar or extreme cold experience were interviewed. A list of these individuals is given in Appendix A.

3. Letters Sent to Authorities on Polar Conditions

In a number of cases, individuals who had cold weather experience were unavailable for personal interviews. With these individuals, personal letters were sent requesting information. A total of 19 letters were sent, the replies abstracted and utilized in the report. Appendix E contains a sample letter.

C. NATURE OF DATA

The material uncovered in the development of this report was, in many instances, subjective and unsystematic. Operational reports indicated the difficulties encountered in the Arctic, but the statements were often general in nature with very little attempt to report in a precise manner the problems found in military operations under extreme cold. This lack of specific information is not the fault of the officers who compiled the reports, since special training is required in the procedures of systematic objective observations. Further, the purpose of these reports was frequently oriented toward problems other than personnel. Definitive answers to personnel questions can be provided only after careful research. This is not meant to indicate that there is no information on personnel problems in polar regions, but rather, that there have been too few studies aimed at the uniqueness of personnel performance. In the course of this report, the terms polar, arctic, and extreme cold are used interchangeably.

D. ORGANIZATION OF THE REPORT

This report is divided into four chapters:

1. Introduction, Chapter I, includes the purposes of the project and a brief outline summarizing the methods that were employed.

2. Operational Recommendations, Chapter II, contains recommendations for changes, modifications, or continuations of present naval personnel policies to more adequately meet polar operating conditions. These recommendations are based upon findings reported in the literature and interviews.

3. Research Recommendations, Chapter III, contains an outline of various problems found to exist under polar conditions for which the existing information is insufficient to make operational recommendations. However, research recommendations are suggested which could provide the needed information.

4. Summary of Findings, Chapter IV, contains a detailed summary of the data which was obtained. This chapter has been organized into five sections, as follows:

1. Selection for Polar Duty
2. Problems of Orientation and Indoctrination
3. The Effects of Polar Conditions Upon Job Performance
4. The Effects of Polar Conditions Upon Morale
5. Physical and Psychological Reactions to Extreme Cold

The bibliography is presented, followed by various appendices.

II. INTRODUCTION TO OPERATIONAL RECOMMENDATIONS

On the basis of the information available regarding manual operations in polar environments, some recommendations regarding personnel problems and practices may be ventured. The data on which such recommendations are based are presented in detail in Chapter IV. While there are many gaps in current knowledge of personnel reactions to extreme cold, this section was written to summarize in part what is known and to recommend what might be done.

The nature of the information does not, in all cases, permit a clear and definitive answer to all the personnel problems met in the Arctic. For example, it is not presently possible to describe how each naval billet should be modified to produce more effective operations in extreme cold. The fatigue effects of working for extended periods in exposed positions no doubt vary for different billets, but how much they vary is not known. Other problems in orientation and training, selection, and morale will also have to remain unanswered until more systematic information is available. Recommendations are presented which could be based upon the information obtained from an exhaustive search of all available pertinent literature and from intensive interviews. The generality or specificity of the recommendations varies with the nature of the data. The recommendations are based on the authors' interpretations of all of the data in Chapter IV. Hence, it is not possible to give a specific bibliographic reference for each specific recommendation.

The fact that recommendations are given here should not be taken as implying that these views differ from current policies. Rather, in some cases, they underline needs which are indicated by the available data. Some of the recommendations which have emerged from the survey of polar information may emphasize the need to continue policies presently in effect. Other recommendations may indicate the need for the establishment of new policies or procedures, or the reorientation of those presently in effect. The areas of research most in need of further exploration are presented in Chapter III.

A. RECOMMENDATIONS FOR SELECTION PROCEDURES

Recommendations which may be offered relating specifically to selection for arctic duty are limited because of the nature of the data upon which they are based. One implicit assumption made in connection with these selection recommendations is that adequate and pertinent orientation and indoctrination will be provided for all men assigned to the Arctic. Without such training, any selection procedures, the performance of many duties, and coping with polar problems would obviously be almost impossible. The recommendations are also

based on the principle of permitting the maximum use of current selection procedures, consistent with the arctic information currently available as reported in the summaries of the survey of the literature.

It would be easy, but not helpful, to use such generalities as "only the best men should be selected for arctic duty." For any strenuous duty it is obvious that the selection of the most skilled, or the most physically fit, etc., would be desirable. These recommendations are aimed at indicating the minimum selection requirements that appear necessary for large-scale polar operations; the approach is to seek to screen out the unfit rather than to select the few highly qualified specialists who would be most desirable. The military situation does not permit the rigid selection procedures employed by smaller-scale expeditions.

Recommendations are made, concerning selection, on the basis of: physical characteristics, intelligence, job skills, personality, background characteristics, and leadership. The recommendations cannot be made specific to all combinations of duty assignment, location, weather conditions, size of group, manpower available, etc. The recommendations made are broadly descriptive. Wherever possible, recommendations are first presented for selection for shipboard duty and then for land-based duty. Land duty in the Arctic is considered to impose greater stress than polar service aboard ship. Accordingly, recommendations for ship duty will, in most instances, apply to the land-based operation.

1. <u>Is special personnel selection for arctic duty required on the basis of physical characteristics</u>?

   a. Shipboard duty

      In general, the man who is physically fit for sea duty should be acceptable for arctic service. However, individuals with a previous history of cold injury, (e.g., frostbite), habitually defective blood circulation, or extensive body scar tissue should be screened out.

   b. Land-based duty

      The standards for land-based duty would need to be higher in terms of physical fitness than for shipboard duty. In addition, the disqualifiers for sea duty (based on scar tissue, cold injury, or circulatory disorder history) would also apply for land duty. The extent of screening should vary with the nature of the duties, the length of the assignment, as well as the location and the available facilities.

2. Are there unique arctic selection requirements involving intelligence?

a. Shipboard duty

No requirements based on the Armed Forces Qualifying Test are needed for arctic duty, beyond those normally used by the Navy for shipboard duty.

b. Land-based duty

A major variable in screening on the basis of intelligence is the number of men who will be serving at the same installation. If a comparatively small number of individuals are to be located at a given base, then men of below average intelligence should be screened out. If, however, other persons in positions of greater responsibility will be present continually, then those of below average intelligence (but still above the Navy selection minimum) can be used. The degree to which it is anticipated that originality, ingenuity, and learning ability will be essential in the operation for each individual should be reflected by the selection level used.

3. Is selection needed for special abilities or duties?

a. Shipboard duty

Special selection is necessary for those in command of the ship and those responsible for its navigation. Previous experience in polar waters would be a major factor. If the ship were to be part of a task force which has other arctic-experienced individuals responsible for major decisions, then, with proper indoctrination, a man without previous arctic service might be selected for top command or navigation duty. If the C.O. has not previously served in the Arctic, then it becomes more important for him to have been a C.O. on a ship elsewhere, prior to his new polar assignment.

For above-deck and specialist billets, the men selected should be fully trained in the performance of their duties. Special selection is not required for below-deck billets.

b. Land-based duty

The men selected must be skilled in the performance of their regular duties and adequately trained in the special problems of arctic living and working.

4. Are there special personality and background factors required for arctic duty?

a. Shipboard duty

In lieu of any special and extensive psychometric screening, one rough indicator which can be used is the individual's past military background. It may be expected that those with poor disciplinary records will make a poorer adjustment than others to the Arctic. In other theatres of operation these men may be a problem but it is not as crucial.

Insofar as can be determined, men selected for arctic duty should be well adjusted with a prior history of emotional stability. Those personality characteristics which are desirable for arctic service are equally applicable to shipboard duty in any part of the world which is isolated, and to situations which place considerable psychological stress on the individual.

While particular personality characteristics and background information may make for more or for less successful adjustment, there are no unique specifications essential for the Arctic.

Geographical background need not be considered as a factor in any major selection program. Men from any part of the United States can serve successfully under polar conditions.

b. Land-based duty

The need for stable individuals applies to selection for any isolated area. It is obvious that the emotionally mature person is more desirable than the immature. The more severe are the conditions anticipated (in terms of stress upon the individual), the more necessary it is to screen out the potentially unstable and to select those whose personality and interests conform to the conditions under which they will serve. In isolated polar outposts those men with more interests and hobbies, including outdoor activities, appear to adjust effectively.

5. Should volunteers be chosen for arctic duty?

Shipboard and land-based duty

It is not necessary, and probably not feasible, to restrict assignments to the Arctic to those who volunteer. The non-volunteer in large-scale military operations can function as effectively in the Arctic as he does under other conditions. This is not meant to imply that the volunteer may not function more effectively in some situations, but rather, that the non-volunteer is capable of an adequate performance.

6. Are there unique leadership skills required for arctic duty on the basis of which certain individuals should be selected?

No recommendations concerning leadership can be made which apply to polar regions but not to other areas or stressful conditions. The importance of good leadership can be underlined, but the techniques or characteristics unique to arctic operations at present cannot be differentiated from those required under other stress conditions. Selection of those with previous polar experience is obviously desirable and adequate indoctrination is essential for those in leadership positions. As indicated (in 3 a, above), the top command should have had prior polar experience.

B. JOB PERFORMANCE

The duties mentioned here are not the only ones requiring modification, but rather, the ones most frequently mentioned in the literature survey and interviews. As indicated in the research recommendations of this report, more extensive, systematic observations of personnel requirements and performance in arctic waters are required before complete answers to the questions can be provided. However, one safe generalization, in line with current practices, is that more men and officers will be required in order to guarantee effective operations.

In connection with the general question, "What duties aboard ship require special attention for operations in extreme cold?" certain more specific questions (1-10) can be raised.

1. What considerations are involved in command duties?

No officer should be assigned to a position of major responsibility until he or his executive officers are thoroughly familiar with the command problems specific to the Arctic.

Special knowledge, experience, and indoctrination are necessary for naval officers assigned to ships operating in arctic waters. Whenever men are under stress in an unknown and threatening environment, it is absolutely necessary that they have confidence in the ability of their officers.

It is also recommended that during their orientation officers should be instructed about the history of the region in which they are operating. They should know the interesting stories of the early explorers and also, information about the "flora and fauna" of the territory as an aid to interesting the men in the operation.

2. What should be done for navigation-ice seamanship duties since radar and other navigational devices are not completely dependable?

The ship's watch officer, the helmsman who is steering, the fathometer watchers, and the lookouts must be organized into a team for efficient operation. The most effective shipboard location of these men in order to guarantee adequate communication and protection from cold is still a matter of controversy.

References to navigation problems emphasize the difficulties of navigation in arctic waters. Any change in the number of officers needed will vary with the type of ship. On icebreakers, for example, it is important to increase the number of officers to guarantee that at least one officer is free of other duties in order to remain in the wing of the bridge to observe the wake of the ship as a guide to the evenness of the course.

3. What can be done for other above-deck duties?

It is not possible, at present, to recommend a specific length of time for watches which will be valid for all types of operations. The effect of wind may be a deciding factor in determining the length of time a man can remain above deck; one report, for example, indicated that men can function above deck in temperatures of 10°F with no wind but cannot work effectively in temperatures of +25°F when the wind is 30 knots.

Due to the added strain in inclement weather, the helmsmen should be rotated every 30 minutes. For watches in exposed positions, the length of the watch on various courses should vary according to the severity of the weather, e.g., one hour in mildly foul weather and only 20 minutes in freezing weather. Frequent reliefs for warm drinks will have a beneficial effect on personnel. For men on battle stations it is recommended that small standby warming shelters be provided wherever possible.

Billets might be reorganized when in the Arctic so as to avoid placing too great a hardship on certain individuals. For example, it is recommended that rotation of jobs should be arranged in cold weather so that the individual can be rotated from an exposed position to a protected one before he is too fatigued to benefit for further duty. One possible rotation from protected to unprotected job groupings might be bridge watch (protected) to boat watch (unprotected).

4. Do below-deck duties require special consideration?

It is generally agreed that men and officers functioning primarily below deck have no unique problems when the ship is in extreme cold. The detrimental effects of excessively warmed compartments in inducing drowsiness and

inattention in personnel engaged in tasks requiring concentration or reasoning, are generally appreciated in every climate. An important problem is the necessity to define the optimal thermal conditions at which personnel will be capable of performing their tasks effectively. (See Research Recommendations.)

On a recent United States Naval Antarctic exercise it was stated that the aim was to maintain the temperature in living compartments between 68° and 82°. This recommendation is, of course, to be considered as a guide rather than as an exact statement of the desirable conditions.

It is also recommended that a careful study of available living space and reorganization of it be accomplished before a ship is sent on an arctic voyage. Aboard ship conditions will be fairly crowded; this will be due, in part, to the increased ship complement (observers, cargo handlers, flight crews). Overcrowding decreases the amount of water available, limiting showers to once a week. Also, the increase in personnel aboard ship will place extra demands upon laundry facilities, requiring additional personnel with specific orientation in the special methods employed in cleaning arctic clothing.

5. What is the role of scouting duties?

There will be an increased dependence upon airplanes to scout ice conditions. In many instances helicopters and long-range scouting planes will be based aboard ships. This necessitates an increase in plane-handling and maintenance crews. Crews should be trained in maintenance and in the raising and lowering of planes over the side of the ships.

Plans must be made for proper coordination between planes and ships. Pilots and observers may give unrealistic reports on ice conditions due to their lack of information about the ship's capabilities. What appears to be a safe and unreportable condition to the scouting pilot, with his insufficient training, may really be quite threatening to the ship's safety.

6. What can be done to assist in performing maintenance duties?

Maintenance crews experience much difficulty in keeping their fingers warm. However, some of the reports indicating great deterioration of personnel effectiveness may be somewhat exaggerated. Actually, reports indicate that cumbersome clothing and icy decks are more responsible for a slowing down than the cold itself. It is recommended that during the time when fine manipulations are necessary, an outer mitt with high insulating value be removed while the operation is carried out by the hand, protected by an inner, well-fitting glove.

In addition, there is a need for additional maintenance personnel due to the reported increased malfunction of equipment. If it is not possible to increase the manpower, it might be desirable to assign (for such exposed cold weather jobs as snow clearance and watches) as many personnel as available so as to limit the exposure time and reduce the amount of additional work required of a few billets.

7. What problems are involved in radio communications?

Increased demands for weather reports appear to necessitate the assigning of one or two radio men to the sole duty of copying weather schedules. This work is highly monotonous and it should be rotated among all men capable of performing this activity.

8. What of supply operations?

Speed, efficiency, and planning are of the utmost importance in landing supplies. There is a tendency in this work to push the personnel quite hard. Work shifts have varied from six to 12 hours. Careful consideration must be given to the optimal length of time that shift crews can work efficiently. Work schedules should be flexible, taking into account temperature, wind, amount of experience, and the adaptation level of personnel involved in the cargo unloading. Unloading requires careful planning and is best implemented through the use of trained cargo handlers and beachmasters overseeing the operation. Drying stations must be set up on shore and, in cold weather of +10°F or lower, care must be taken that personnel do not oversweat and then be required to stand around exposed to the cold.

9. What measures can be taken for personnel on amphibious operations?

In landing troops, the following precautions are necessary for successful operations:

a. Waterproof covering for troops to protect against spray. This covering should be light and expendable.

b. Troops debarking on amphibious operations should not be required to don bulky clothing until immediately prior to leaving the landing craft. In some instances it may be worth while for them to don bulky clothing until they are ashore, since the heat from the landing barges and their level of activity should protect them during the landing.

c. Constant checking of landing nets to prevent them from freezing is also necessary.

d. Boat crews kept on duty constantly on amphibious operations require frequent relief when temperatures are below +20°F. However, the effective working period of boat crews may be increased in extreme cold by devising heated landing craft which also offer protection from spray.

e. Damage to landing craft caused by rocky beaches may, at times, be expected. Sufficient replacement parts should be available, as well as facilities to effect such repairs.

10. What mess personnel procedures are needed?

Mess personnel should be specifically trained in the necessary procedures involved in the setting up of field kitchens and the preparation of food under polar conditions. Special techniques are required to transport and keep food hot under extreme cold. Also, special information is required concerning the cleaning of utensils and the preparation of special foods and dietary requirements. For example, food like pemmican can be prepared in a variety of ways so as to increase its palatability.

11. What recommendations can be offered concerning job effectiveness for land operations?

While the study was oriented primarily toward naval job requirements, certain land and air problems were also mentioned. Since the Navy does maintain land installations, such as weather stations as well as land-based aircraft, it may be helpful to summarize some of the recommendations concerning their problems.

a. Supply, maintenance, and communication

The relative isolation of arctic posts and the limitation in means of transportation requires that provision must be made to store quantities of equipment, food, and other necessities. Adequate allotment must be made for proper coordination between the base and its source of supplies.

This problem of isolation further requires that every unit must be made relatively self-contained. Provision for maintenance and repair of machinery must be available. Specialists of all kinds must be available at the base. Medical problems, for example, should be treated at the base whenever possible. Vehicles often require immediate repair and manpower with adequate equipment must be available.

The physical layout of the camp must be carefully planned. It is recommended that the conventional layouts for camps should be discarded in favor of more functional arrangements in order to reduce the necessity of long treks through the snow. For example, one weather station placed the parking area for planes near the fuel caches, allowing the planes to be refueled without the necessity of transporting gasoline drums.

b. Individual efficiency

It is necessary for personnel to have special information in addition to the usual training given for duty assignment in other parts of the world. The individual's adjustment to extreme cold and cumbersome clothing can be greatly improved by training. Many failures of equipment are due to improper training. However, it is also necessary to consider other procedures in addition to training and orientation.

For example, many "tricks of the trade" have been found very effective in facilitating the performance of various billets. The techniques presented below were collected from a wide variety of sources. While they are certainly not a total listing of all the various possible procedures for effective operations, they are presented because they are of general interest, and further, are not available in any one specific study. As recommended in the Research Recommendations section (Chapter III) of this report, an effective survey of performance under extreme cold would provide this information in more complete form.

Reports indicate that it was found effective to direct sources of warm air onto the hands of mechanics working in the open, and also upon their equipment.

Tools should be wooden-handled in order to facilitate handling. Carpentry work can be carried out if nails are heated so that they may be driven while the carpenter is wearing light pairs of cotton gloves.

Heads of screws should be enlarged to permit easier handling.

Extra tools and equipment must always be available so that, in case of breakage or loss, the worker does not have to interrupt his duties to seek replacements.

Due to loss and breakage, twice as many tools as would be included in an exercise conducted in temperate environment should be brought to the Arctic.

Repairs which must be accomplished in the open should be limited as much as possible to replacement of broken parts with complete units, rather than attempting to repair these damaged parts.

Starting the motors of vehicles frequently represents a problem which has been effectively solved on many expeditions by running the engine all night to avoid the possibility of its failing to start up after a few hours. Another more economical alternative has been to leave the engines of a few prime movers turning over and use these vehicles to start the others.

The operation of supply tractor trains requires highly trained technical personnel, as all units must be self-sustaining. Each man must be familiar with his vehicle so that he can detect and make repairs on the spot. They may also be required to improvise methods and make repairs more often than would normally be required.

Driving over dry snow usually cannot be done effectively at maximum level of ability for more than eight hours. It is also recommended that two mechanics be assigned for each 15 vehicles.

Certain kinds of duties cannot be performed in very cold weather. For example, at temperatures of -50° surveying is not accurate, taping difficult, transit hard to keep level, transversing not practical. However, triangulation is possible if fires can be built to warm operator and recorder.

c. Air

There is very little systematic information describing unique job requirements for pilots under arctic conditions. Whatever flight problems exist, as indicated by the literature search, are summarized in another section of the report.

Pilots, navigators, and radio personnel must be familiar with techniques of polar navigation and communication. Survival techniques should be taught, varied according to the type of terrain which shall be flown over. For example, survival techniques are different below the treeline than above it.

Pilots should be trained in landings and take-offs from small landing strips. In winter, ski landings will be required at times and pilots should be afforded practice in this technique. Emergency landings on ice require that pilots be trained to distinguish safe from unsafe patches of ice through distinctive cues.

In summary then, one can only make general statements about the effects of the Arctic on job efficiency. Information about changes in performance for specific billets must await further research.

C. RECOMMENDATIONS FOR ORIENTATION AND INDOCTRINATION

Any polar orientation and indoctrination program must deal with problems of living and self-maintenance under arctic conditions, of learning to make the adjustments needed to work in the Arctic, and of developing attitudes which will enable the individuals to function effectively.

The recommendations given below do not specify the content of the indoctrination. The concern is with the nature and the types of orientation which should be presented. No attempt is made to prescribe the amount of time which should be required for the most effective indoctrination.

The relationship of job requirements and selection procedures to orientation is apparent. Adequate training can obviate many of the problems which have been encountered on previous polar operations.

1. Is special orientation and indoctrination needed for men assigned to the Arctic?

   Men assigned arctic duty must receive special orientation prior to their arrival in the Arctic. Living and working in the Arctic cannot be assumed to be the same as living and working elsewhere. But with the proper preparation men can learn how to cope with the problems which arise just as they can for other stress-producing situations, such as military operations.

2. Who shall receive special indoctrination for the performance of duties and skills under arctic conditions?

   a. Shipboard duty

      Those responsible for the command and the navigation of the ship must receive special indoctrination.

      In addition to being specially selected for arctic duty, the Commanding Officer of a ship must be thoroughly oriented concerning the unique stresses placed upon job performance, living, and morale by polar conditions. If he has had previous arctic experience, although not as a C.O., then a framework will exist for this additional orientation.

      Other officers and petty officers not only must be indoctrinated themselves, but also be prepared to teach others before and during arctic operations. Those responsible for navigation duties must receive thorough indoctrination in ice seamanship unique to the Arctic.

Billets which require duty performance above deck must be indoctrinated thoroughly in the performance of their tasks under non-polar conditions, as well as in the changes which are required for polar performance. Training in the performance of duties while wearing arctic gloves and clothing should be given under warmer conditions than those to be encountered later. Even if such practice is brief, the individual will be able to perform better when is is actually required to use arctic clothing later.

Orientation is obviously necessary in any of the problems of handling, (including stevedoring), maintenance, and repair of equipment and material under conditions of extreme cold. A thorough understanding of the effects of extreme cold insofar as it will affect their use of the equipment will be required for emergency conditions.

For the performance of below-deck duties, no special indoctrination is needed except that information which would be affected by working under emergency conditions.

b. Land-based operations

The operation, maintenance, and repair of vehicles requires special training. Skill must be acquired prior to arctic service in the knowledge of the effects which extreme cold will have on materials and equipment.

Orientation in the problems to be encountered in the performance of each billet (e.g., communications, medical, etc.) under extreme cold must be given. As with shipboard operations, those in command must have a thorough knowledge of arctic problems.

3. What should be done concerning indoctrination for living and self-maintenance under arctic conditions?

Before he is assigned to extreme cold weather operations, every man must have thorough information on the principles of body maintenance, health, and survival problems. They must be taught why various measures, such as preservation of body heat, are needed as well as what actions are necessary.

Training in frostbite prevention is essential. Even though this recommendation seems obvious there is evidence that lack of adequate training in self-care has occurred and seriously hampered operations.

The use of arctic clothing requires training. Merely issuing the equipment is not enough. Knowledge of proper procedures and their rationale when going back and forth from a heated (e.g., below deck) environment to a cold environment is needed.

4. Is indoctrination under cold weather conditions necessary?

There are definite advantages to training under cold conditions, both for job-skills performance and for self-maintenance. The gradual acclimatization which occurs is valuable in increasing later effectiveness. Practice is desirable under cold weather conditions, but does not seem essential. However, all skills (job and self-maintenance) must be thoroughly acquired, even if the training occurs in warmer climates. When extended cold weather practice is not possible, then the use of cold chambers for short exposure is suggested. Each man might, even if only for a few minutes, receive some idea of the conditions to which he will be exposed, and possibly the effectiveness of his clothing and his equipment. Such exposure, however, must be so presented as to build up respect in the individual for his ability to cope with the cold and not used just as a stimulus to fear.

5. What orientation is needed on attitudes toward the Arctic prior to assignment?

Neither over nor under-emphasis of arctic problems is desirable; the approach should always be realistic. To present the hazards without presenting the means by which these can be dealt with is undesirable. Simultaneously, the attitude of a realistic respect for the dangers must be presented.

Material which attempts to influence attitudes toward polar assignment should be given as part of the indoctrination for living and for working in the Arctic. There should not be a separate "propaganda" course. In teaching men how to use their clothing, operate equipment, or prevent frostbite, the orientation should be positive, in terms of development of skills and not just a negative fear-producing approach.

6. What indoctrination approach is needed to help maintain morale?

a. Shipboard duty

Orientation should be directed toward interesting the men in the Arctic. To be effective this will require indoctrination by a group of officers and not merely the morale officer.

The need for maintaining morale is not unique to the Arctic; neither are the morale problems which arise. But the material which can be used to

arouse interest concerning polar regions is unique, e.g., geography, native peoples, and the history of the early explorations in the area.

b. Land-based duty

Indoctrination in attitudes of responsibility towards the other members of the group is even more necessary in the Arctic than elsewhere. The continued use of the "buddy-system" to help in preventing frostbite is recommended.

Prior practice is valuable in working together as part of the team which will later be together in the Arctic.

7. How should the Arctic indoctrination schedule be arranged?

The indoctrination schedule for men assigned to arctic duty should cover both living and job skills in an integrated organization rather than separately devoting a number of days to self-maintenance skills and problems, and then a later series to job performance.

Leave should be given before starting arctic training, and after the orientation the men should go directly to their arctic assignment. This would avoid those situations in which men have become acclimated during training given under cold weather conditions, and then had the continuity of adaptation to cold disrupted.

8. Should training be conducted aboard ship?

Shipboard training, while enroute to polar areas, is undesirable unless training programs are set up by some central unit with rigidly adhered to schedules. Too often, responsibilities and duties prevent men from actively engaging in any organized training program. While refresher training aboard ship is helpful, it cannot replace a formal indoctrination program.

D. RECOMMENDATIONS FOR MORALE

The factors making for good or poor morale are not unique to the Arctic. Nonetheless, the isolation and stresses imposed by polar conditions, and the periods of almost continuous darkness or daylight do intensify morale problems.

The recommendations given for the questions below would not apply exclusively to arctic operation; but their importance is underlined by the findings concerning morale.

1. What can be done by administrative policies to maintain high morale?

Administrative policies are of great importance in keeping morale high in cold weather operations. Establishing and publicizing leave policies, rotation procedures, promotion policies, and being consistent in carrying out such policies are related to high morale. Making goals of operations clear to personnel is essential. The length of tour of duty in cold climates and the objectives of the operation (within security limitations) should be presented. It is also of value to maintain a flow of information telling the men how their work relates to the over-all objectives of the operation.

2. What morale factors need to be considered?

As in any military situation, good living and working conditions, and good leadership are important. Proper job assignments and appropriate training are particularly important for morale under polar conditions. The importance of high motivation is accentuated in the Arctic (as compared to other areas) by the handicaps under which men must operate. Performance will be hampered if they feel that they are not qualified or trained for their job billets or for daily living.

Confidence must be established in their ability to cope with the needed living adjustments. This problem is not unique to the Arctic. But in many climates, the extent of the hazards and interferences in their routines of billet performance and of self-maintenance are not as great as under extreme cold.

A corollary of the need for confidence in themselves is the need for confidence in their officers. Because of the potential seriousness of a failure in leadership in day-to-day as well as in combat situations, the role of the officer is even more important in the Arctic than elsewhere.

Recreational facilities are necessary in developing recreational programs; it appears to be most important to make sure there are a great variety of activities,e.g., motion pictures, games, cards, musical shows, sports, libraries, hobby shops. It is necessary also to determine what the men prefer. There is no point in maintaining facilities in which there is no interest.

3. What morale problems are most in need of attention?

The relative importance of morale problems will vary with the particular operation being considered. These variations in emphasis are, in part, a function of such factors as the degree of isolation, the length of stay, and the quality of leadership.

It is recommended that regularly scheduled surveys should be conducted in order to determine what the specific morale problems are for given groups at given times. Anonymous questionnaires should be used and every effort should be made to implement the results. It would then be possible to determine the role of living conditions, leadership and recreational facilities in determining the level of morale in a given situation.

III. RESEARCH RECOMMENDATIONS

The literature search, interviews, and the operational recommendations, together produced a body of information concerning present knowledge about personnel operations in polar regions. This information is not sufficiently clear and complete to offer answers to many of the pertinent questions about personnel operations under polar conditions. However, while this search leaves many important questions unanswered, it does point up the areas in which research is most needed.

The research suggestions offered in this section are based not only on a search for information to complete gaps in our present knowledge, but also reflect certain approaches found fruitful in military psychological research programs. The outline for the Orientation and Indoctrination section is, for example, based on techniques developed by RBH in a wide variety of training installations. The concern for criterion research in the Job Performance section stems from a realization, as indicated by many sources, that basic research must, in many instances, precede the application. The various research suggestions are interrelated and do not refer to any specific reference mentioned in Chapter IV. Each will contribute to others; however, it is not necessary to complete one of these prior to undertaking another. This section is organized to provide continuity of subject matter rather than priority of research needs.

A. SELECTION RESEARCH

1. Do we have enough information on selection procedures for the Arctic?

There is not enough information available today which can be used for the improvement of arctic selection procedures. The literature and interview data (summarized in Chapter IV), which serve as a basis for the operations recommendations, are not systematic or clear-cut. Because of this, a large untapped potential, in terms of the effective functioning of manpower, may be unrealized.

Selection procedures can undoubtedly be improved for any specific purpose. Under conditions of extreme national emergency arctic manpower and needs may be critical. This would require a greater specificity of information on characteristics which are desirable and, most particularly, on disqualifying characteristics.

The basic question, for arctic selection research, is whether it is practical and feasible to improve selection for "typical" Navy arctic operations, or conversely, whether the Navy can afford not to investigate whether or not change is desirable. Research investigations, specifically designed to provide the information needed, can help to serve as a basis for such operational decisions.

2. How should such a research program be organized?

A battery of tests can be developed in order to study systematically the personal characteristics which are at present associated with success in specific as well as over-all arctic performance. These results would be compared with unsuccessful and successful performance elsewhere. Research on such a test program would include the following steps:

a. Tests would be administered to a sample of men before they have received any specialized arctic training.

b. The development of these tests, both paper-and-pencil and performance tests, could take advantage of material now known. Items must be constructed so as to deal with aspects of behavior or types of adjustment relevant to adjustment and survival in the Arctic. Items from the following areas, utilizing the information provided in Chapter IV might be incorporated into such a battery.

Physical -- vasomotor responses, resistance to cold injury, previous medical history, body structure

Background -- interest patterns, marital history

Abilities -- intelligence, mechanical abilities

Personality -- self-sufficiency, emotional stability

Leadership -- characteristics of effective leadership

Work performance

c. Criteria for evaluating items on these tests might include such measures as:

Job effectiveness measures as evaluated by superior officers

Ratings by subordinates or peers

Such indices as: failures to complete training, cold injury

Different scoring keys might be developed for different types of Navy operations, e.g., prolonged land or amphibious operations as contrasted with shore patrol or icebreaker duty. Differences related to billets would also be studied, e.g., maintenance, below-deck watches and land-based operations. Validation of any parts of this test program could use material obtained at various stages of pre-arctic training as well as actual arctic performance criteria.

3. What would be the benefits of such a program of research in selection?

The first benefit would be derived from the increased effectiveness in the selection and billet assignment of personnel. It might be found, for example, that no change in selection is necessary but rather that personnel, once selected, (utilizing current procedures) could be assigned to those billets which would most effectively utilize these abilities and potential.

Second, it would be possible from the results of this test program to identify those skills required for successful arctic performance.

We still tend to think of skills as they are needed under normal conditions. Before the Arctic loomed as important in our operational plans, it was not necessary to investigate to see if there were generally unused skills which were needed for efficient performance. Similarly, it was once not necessary to tap those motor skills required for pilots or bombardiers before development of the airplane.

Research is needed to identify those skills, if they exist. The basic question is whether it is a different weighting (loading) or organization of present skills (i.e., a different test profile, with quantitatively more of present skills needed) or whether there are qualitatively different performances involved. The results of this test program can provide the information required.

Third, the test battery will assist in the evaluation and redefinition of training goals. A redistribution of training emphasis might be considered in view of the test results.

B. TRAINING RESEARCH (ORIENTATION AND INDOCTRINATION)

Training is the area in which there appears to be the greatest need for immediate research. Many problems in job performance, selection and morale can be approached and alleviated, in some instances, through more effective orientation and indoctrination programs. For this reason, the answer to Question 1, below, is presented in greater detail than the answers to the other research questions.

It is assumed that research or training should be preceded by research which will establish criteria of effective job performance and living under the special conditions imposed by polar operations. However, certain applied training studies can be undertaken even in the absence of such basic criterion research.

1. How can arctic training programs be studied?

Systematic observations by skilled investigators have proved valuable in understanding and evaluating training programs in a wide variety of training establishments. The basic theory underlying the use of such observations is simply that one can better understand the training program by viewing it through different sets of eyes. More specifically, observations can be collected through interviews with the people who are all intimately involved in the given training program.

First, how does the indoctrination program look to the instructor who is attempting to communicate his material based on his study of and experience with cold weather operations? How is the program, in his opinion, practically and meaningfully related to the over-all goals of effective personnel performance during naval operations in cold weather? Many more detailed questions would, of course, be used after preliminary discussions with the instructors.

Second, how does the training program appear to the student who has just about completed his course? Does he feel that he has been adequately trained? Does he look forward with confidence to his new assignment? Does he feel that he has learned the behavioral modifications necessary for the successful performance of his billet? Is he prepared and does he understand the problems to be encountered in arctic operations? A questionnaire could be developed after preliminary interviews with students.

Third, the men returning from arctic duty would be interviewed. The goal would be to obtain as much detailed information as possible. More specifically, what did they feel had been the strongest point in their training programs? What were the major weaknesses of their training? Detailed descriptions would be obtained of both arctic living and working experiences which they were able to handle because of prior orientation and training,

and with which they would not have been able to cope without such earlier orientation and training. What difficulties did they encounter (again in both working and living) which could conceivably have been overcome with better previous orientation and training? In summary, then, the interviews with graduates should pin down the major strengths and weaknesses of programs as they are presently given.

Fourth, having collected and analyzed these observations, it will still be necessary to check them against the observations gathered by individuals skilled in training evaluation studies. An "observer check-list," based on the previous interviews, would be developed and used for observations of training needs under actual cold weather conditions.

Fifth, an advantage of a research approach such as that outlined above is that indoctrination programs can be studied and evaluated without disrupting the normal routine of the particular training which is in operation. Recommendations can be made for modifications and improvement of syllabi, course curricula and presentation methods from such a study.

2. What other training research questions can be considered?

From the evidence available, it appears that actually living and working under cold conditions before being sent to polar areas helps the adaptation and work adjustments of the individual. Whether such training would be warrented -- in time and expense -- could be evaluated in terms of actual personal adjustment and billet performance under arctic conditions. (The cost of such training as part of the selection process would also be evaluated.)

a. To what extent does training on a skill under cold conditions affect the later performance of that skill? What should the optimum amount of time be for such training?

b. What is the comparative effectiveness of orientation programs given under non-cold conditions, compared to the same training under cold conditions?

c. Can individuals be selected who will require a minimum of training and yet who will satisfy performance criteria? On the other hand, is it more appropriate for Navy purposes to determine the minimum standards of training which will enable most men to perform satisfactorily under arctic conditions?

d. What special problems are involved in the training for command duties in the Arctic?

C. JOB PERFORMANCE

1. Is there a unique polar effect upon personnel performance?

It appears that performance of various tasks is affected by polar conditions. What is not known is the relative influence on performance of each of several factors which constitute what is commonly known as "polar conditions," e.g., low temperature, and wind changes (windchill), isolation, hazardous duty, fear, and stress due to the absence of a familiar environment. Other important influences seem to include: differences in recreational facilities, living conditions, clothing problems, length and indefiniteness of assignment, and leadership. Many factors can cause a man to behave differently in the Arctic than he does elsewhere. All of the above conditions may simultaneously be affecting the man's adjustment and performance. All that can be observed are the gross changes in a man's reaction. Before we can assume that it is just the extreme cold itself that is causing a loss in efficiency, it is necessary to control the effects of the other influences that occur with arctic living. After careful research the effects of cold may be found to play a relatively minor role while, for instance, the isolation and fear of the unknown may produce the greatest interference with a man's effectiveness. All the major factors thought to be operating should be controlled in research in order that training and selection programs can be built upon empirical information. Research is necessary in order to determine the relative effects of these polar factors, operating singly or in combination.

This discussion, up to this point, has been directed towards the identification of those factors influencing a man's performance. But we cannot neglect the fact that polar performance involves many specific types of adjustment. Separately or simultaneously, there may be physiological acclimatization to the cold, or variations in the way the man functions on his job, or differences in the way he feels towards his assignment, his officers, and his shipmates. All of these types of behavior and feelings are affected by so-called polar conditions. Research questions must then be aimed at the effects of specific polar conditions upon specific behavioral adjustments.

In the long run, it will be necessary to determine the effects of cold, isolation and fear, etc., separately upon each of the aspects of performance. It may not be possible or practical at present to initiate such a thorough, elaborate and basic research program. However, it would be possible to start with the key question: What are the effects of cold, per se, upon specific aspects of job performance? A research approach to this problem can be outlined as follows:

a. Samples of individuals matched for various important characteristics (e.g., ability, physical stamina) would be selected.

b. The job tasks by which the effects would be judged would be specific realistic aspects of the work performance required in typical above-deck Naval billets.

c. Measures of performance in the various assigned tasks would be obtained under the following conditions:

Laboratory conditions, temperatures 68 - 72°F.

Laboratory conditions with simulated cold and windchill levels with temperatures equivalent to those encountered in arctic conditions.

Shipboard performance of the tasks above deck in the Arctic.

Shipboard performance of the tasks above deck in temperate climates.

Such a research program would help us to separate the effects of cold as such on above-deck billet performance from the other factors usually combined with it under the term "Arctic Conditions." Such an elaborate research program would provide important basic data. However, it is still possible, in the absence of such extensively controlled studies, to conduct research studies aimed at more immediate applications.

2. <u>What are the differences between performance of specific above-deck billets under arctic and non-arctic conditions</u>?

It is comparatively easy to know when a job is being done inadequately. But we do not have the data which would enable us to know what constitutes an effective performance under arctic conditions as compared to other conditions.

The present information which we have indicates that below-deck billet performance does not require special adjustments, but that above-deck performances are affected.

It is necessary to obtain quantitative data on the amount of change in specific performances with variations in specific windchill levels.

For example, in the literature summary on Job Factors, the statement is quoted, "An individual's efficiency drops 2% with each degree of temperature drop below 0°F." No actual data can be found to support or to deny the accuracy of this statement. It is a view familiar to those dealing with polar operations, but no source seems to be able to provide the substantiating data. The following research is suggested as a means of obtaining quantitative, systematic information in connection with typical above-deck billets.

A systematic measurement of the specific activities and movements involved in representative above-deck billets would be undertaken. A number of motion pictures taken while the man is performing a given task under above-deck and below-deck arctic conditions might be one approach to this problem. Such pictures could be analyzed in detail showing speed of movement, precision of movement, organization of job duties. Other supplementary procedures for the analysis of the movements required on the job might include interviews with experienced personnel where descriptions of "critical incidents" could be obtained. This information about job performance could then serve to identify those aspects of performance which are affected by polar conditions. With this information available, specific billet requirements for arctic duty could be met by appropriate adjustments of the job or readjustment of training goals. Information would thus be obtained as to:

a. The performance of tasks involving strength and endurance affected by polar conditions;

b. The amount of additional time required to perform specific tasks;

c. The extent to which additional personnel are used -- or needed -- in order to get specific jobs done in the "usual" time or required time. It is one thing to get the general statement that more men are needed to do a job, but another to know where they are needed, if they can be kept on shipboard, what billet or schedule reorganization can be made, etc.;

d. The changes, if any, are in accuracy or quality of job performance. The question of whether specific jobs are done with less skill or whether increased effort is or can consistently be made to compensate for the handicapping effects of the weather. Data would exist, then, to show if skill must be greater than in temperate climates in order to achieve a minimum level of acceptable performance.

3. <u>Are there any special problems on the design and handling of equipment under extreme cold in polar conditions</u>?

There is need for research in this area of human engineering to indicate whether present equipment should be redesigned or replaced in order to

facilitate personnel operations. In many instances the literature has indicated an inadequacy in the construction of and handling of gear which was originally designed for use in temperate climates and which now must be operated in the Arctic. Such a simple thing as painting tools a different color so that they can be easily found if lost in the snow has been recommended. However, more complex problems are involved in the design of equipment which must be handled by personnel who are wearing typical arctic clothing. Such items as control knobs, handles, levers, pulleys, as well as such typical tools as wrenches, pliers, screwdrivers, might also be used in research to determine their suitability for arctic conditions. For extended land-based operations, repair and maintenance of equipment require far more extensive experimentation in this vital area of man-machine relationships.

4. What additional problems require research answers?

Various other problems or questions occur in connection with performance in the Arctic. Some of these are indicated below:

a. Are there critical temperatures, or critical windchill ranges below which work is severely affected? Is the decrement in performance (measured in terms of fatigue, time and accuracy of work) gradual, or are there sharp breaks in any graphic curve of efficiency performance as the temperature is lowered or windchill changed?

b. What is the optimum schedule for length of Navy watches on shipboard? Should these schedules be varied as the windchill factor changes?

c. What problems of job performance are introduced by different types of Navy operations in cold conditions (e.g., amphibious, prolonged land operations).

D. MORALE AND ADAPTATION

1. Are there research questions which emerge concerning morale and acclimatization in the Arctic?

Throughout the survey of the literature and in the interviews conducted, the importance of "keeping morale high" was stressed. In arctic regions the morale of the group is generally reported as being of greater concern than it is in other areas. The term morale is used in its most general sense, with no rigorous definition of morale as a functional unity implied.

No basis is offered for assuming that there are any morale factors which are unique to the Arctic as such. The problems of what are the needs which must be satisfied and what the Navy should attempt to do in order to assure good morale are apparently the same as in other areas and situations.

However, the view that unique Arctic morale factors have not been described does not lessen the need for research under arctic conditions on morale questions. While the techniques and variables involved are not unique to polar operations, research is needed to determine if there are answers which are unique to the polar conditions.

2. What research questions arise concerning morale measures and job performance?

There is a paucity of data which relates morale measures to job performance. Without considering for the moment the problem of maintaining good morale for the sake of the contentment of the men themselves, there are problems of the interactions between morale factors and job functioning.

a. What are the relationships between morale measures (the attitudes held by the individuals, for example) and quality or quantity of job performance of the individuals and of the groups to which they belong?

b. Are there demonstrable relationships between morale measures and the effectiveness of the operation of their mechanical equipment (e.g., equipment failures, time needed for mechanical repairs)?

c. Can any direct relationships be found between morale and records of weather (e.g., temperature, windchill) and performance (with other factors held as constant as possible)? For example, does the onset of extremely severe cold act as an intensifier of whatever morale state (high or low) already exists; does it produce any predictable change?

d. What are the relationships between billet assignment, job performance, and morale? Are men who are not working at their own specialty likely to have low morale but still work effectively?

3. What research is needed concerning the relationship of leadership and morale?

Present arctic and Navy conditions indicate leadership as a prime morale variable. There is as yet not sufficient evidence -- pro or con -- to show that specific leadership requirements are different for arctic than for other Navy service.

a. The hypothesis that there is no fundamental difference between leadership characteristics and interactions in the Arctic as compared to that of other naval operations could be tested.

b. Are there specific criteria of effective leadership which are particularly appropriate to arctic areas? Morale studies, buddy rating, and other traditional criteria of leadership characteristics can be evaluated.

c. Can orientation and indoctrination of leaders obviate or lessen the need for special selection of personnel?

4. <u>What research is indicated involving attitudes towards the goals of the operation</u>?

The feelings of participating in and of belonging to the group appear important for morale. Men who have a clear picture of and identify themselves with the goals of the operation and how their unit and their own assignment fits into this picture appear to have higher morale than those who do not. It may not be possible to produce the sense of personal goal identification which appears to exist in the explorers and scientists who have gone to the polar regions. Nevertheless, study would be appropriate in the area of increasing the extent to which an individual feels part of the group and considers the goals of the operation to be his goals. Some questions which occur are:

a. Can valid measures of an individual's identification with and acceptance of the goals of an arctic operation be developed? By what criteria can such measures be validated?

b. What are the most effective areas for producing identification with the objectives of an arctic operation (e.g., patriotism, self-development, nature of the arctic life, additional pay)?

c. What are the methods for producing this identification (e.g., lectures, movies, group discussions, patterns of leadership, actual experience)? Do these methods vary in their effectiveness with the stage of training or arctic service?

d. What are the interrelationships between the amount of identification with the group objectives, the actual job performance, and the work and recreation facilities and conditions? Can a strong identification neutralize or minimize the effects of inadequate facilities; or is identification weakened considerably by such inadequacies?

e. To what extent is the harmony of the interpersonal relationship affected by the extent of identification with group objectives?

f. What is the role of leadership in the situation?

5. What research questions occur in connection with acclimatization?

Aside from the assumption that there is a physical process of acclimatization, little practical information which could serve as a basis for formulating policy is available. The following research questions should be considered.

Research in the area of psychosomatic medicine leaves little doubt that there frequently is some interaction between physiological functioning and psychological conditions. Typical studies heretofore have included: psychological factors in the development of migraine headaches, duodenal ulcers, etc.; the effects of conditioning upon such anatomic functions as vasomotor activity; the adjustment and development of sexual patterns under the influence of social conditions; the development and stability of food preferences. While the extent and the exact nature of this interaction is not yet clearly formulated, there is still sufficient evidence to warrant a close examination of these adjustive relationships under arctic conditions. Questions which are to be studied are:

a. What is the correlation between psychological changes and physiological acclimatization changes?

b. What measures are needed in the determination of these correlations?

c. Is physiological acclimatization important for effective shipboard performance?

In the Navy situations, groups of men operating under similar conditions with different individual adjustment patterns could be studied closely. As a starting point for the study of these questions, one might seek individuals whose initial psychological adjustment is high, but who show little physiological change. Individuals with the opposite pattern might also be sought. The specific details of the program would follow the procedures developed in the area of personality research.

IV. LITERATURE AND INTERVIEW DATA

The literature and interview survey in this section of the report is presented within traditional personnel research categories. The orientation was to have organization take precedence over the literary style.

Further, the material quoted in this section was obtained from a wide variety of sources, and the inclusion of any reference to specific reports in the chapter does not in any way reflect the author's endorsement of the findings. The nature of the data is discussed in the Introduction and is referred to in various parts of this report.*

This chapter is concerned with a comprehensive coverage of most available literature; the psychological and operational and research implications were presented in Chapters II and III.

The references to the interview data are made without identifying the specific source of the statement. It was felt that the confidences of the individual interviewee would be safeguarded by this procedure.

The research was, of course, primarily concerned with naval operations, although in order to provide the most comprehensive coverage, studies from other branches of the military organization were included. Within this chapter, the material concerned with selection for polar duty is dealt with first, then the material on orientation and indoctrination is presented, followed by the data on job performance in the Arctic. A section on morale problems is presented next; the final section deals with general reactions to extreme cold.

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* The data presented in the following section were based on the integration of both the interview and all the available references in the bibliography. However, not all the studies are referred to specifically in the body of this report.

A. SELECTION OF PERSONNEL FOR POLAR DUTY

The search of the literature was organized with a view toward seeing if there were sufficient data to answer questions on selection which are of primary concern to the Navy. The questions are:

> Is special personnel selection for polar duty required on the basis of physical characteristics?
>
> Are there unique selection requirements involving intelligence?
>
> Is selection needed for special job skills or abilities?
>
> Are there special personality and background factors required for arctic duty?
>
> Are there unique leadership skills required for arctic duty on the basis of which certain individuals should be selected?

Following a consideration of the nature of the available data, the literature summary on selection will deal with the information concerning: (1) the physical characteristics that are related to successful adjustment and performance under arctic conditions, (2) intelligence, skill and ability factors, and (3) personality, background, and leadership characteristics.

Nature of the Data: Material on the selection of personnel for arctic operations is generally descriptive in nature. There are few sets of systematic data showing the selection techniques used, the scores on tests given before arctic service, or the relationships between measurement of individual characteristics (which could be obtained during a selection process) and measures of later performance under arctic conditions.

The material summarized does represent the best information currently available from reports and from interviews with men with extensive arctic experience. This section is primarily oriented toward minimum selection requirements rather than classification or assignment.

Special Operational Requirements: For most ship operations, the availability of a warm environment below decks is reported as obviating the need for any special selection procedures (interviews). Most of the material summarized below is derived from experiences with land-based operation and is most applicable to them. That material which does specifically apply to or deal with selection information unique to ship-based arctic operations will be noted.

1. Physical Characteristics Pertaining to Selection

General physical fitness is obviously an important requirement for men who are to be subjected to arctic conditions (192, 63, 188, 22). This requirement is not generally thought to be unique to arctic military operations. In laboratory studies of warm conditions, it has been found that the man who is most fit for long-sustained work in a temperate environment is also most fit for similar work in heat. The extent to which this also applies to cold conditions is not indicated (39).

a. Ship operations

For sea and amphibious duty, medical authorities believe that anyone who is qualified for regular sea duty can endure a trip in the Arctic and Antarctic (136A). Those characteristics which would usually disqualify an individual from service aboard ship would still be disqualifiers for service in the Arctic.

Under conditions of severe cold, there is a rapid acceleration in the loss of bodily heat. To curtail this heat loss, the peripheral circulatory system contracts, cutting down the flow of blood (and heat) to the hands, feet, and face. Thus, for individuals having extensive body scars, suffering from habitually defective circulation, or having a history of such illnesses as rheumatism, this curtailment of peripheral circulation may be quite damaging (101). Permanent deformities of fingers, hands, or feet which interfere with wearing of cold weather clothing have been conditions used in (Army) screening procedures (43A).

In extreme cold (around -50°F.), some temporary damage to the upper respiratory tract can be expected. Exposed individuals will at times develop coughs, spit blood, and be subject to nosebleeds. To some extent, these results indicate that individuals with a previous history of sinus or other respiratory diseases of a similar type will experience more hardship when exposed to extreme cold. Mention of respiratory damages seems to be limited to individuals who spend a considerable share of their time outdoors (189).

A history of cold injury (e.g., from severe frostbite) may be used to disqualify men from arctic service; medical research is reported in progress which indicates the possibility of bone damage from severe frostbite (interviews).

b. Land (or non-specified) operations

Land-based operations in the Arctic generally place greater demands upon individuals than do ship-based operations. The selection characteristics mentioned above for ship operations would also apply to land-based operations. There are known variations in the ability of individuals to perform under cold stress, e.g., resistance to frostbite, working with unprotected hands (15), and ability to withstand longer exposures (24). Some men's faces freeze quickly after short exposure, others require longer exposure. There are also variations in the pain threshold to freezing (63). Much of this resistance may be assumed to be caused by the fact that men who have worked outdoors over continuous periods are less susceptible to cold stress (63).

It is reported that those who are predisposed to cold injury should not be selected, nor should those with a prior history of cold injury (50). Effective cold predisposition tests are not yet reported. Reactions to immersion (of the feet) in cold water were not a specific indicator of performance under cold stress, although some medical research leads were indicated. Various physiological indices, e.g., pulse, blood pressure, did not serve as predictors (4). Laboratory studies indicate differences between men in their relative capacities to remain comfortable in cold (87). Men should be able to give out sustained effort over long periods of time. Normal hearing ability is needed (93A). A maximum age of 30 for the lower three grades of military personnel is reported by one source (119A). A medical screening resulted in few ill effects from cold on one operation (40).

There is controversy as to whether men with eyeglasses can be used. Some sources report that fogging and frosting of the lenses create a problem, but recommendations are constantly made that sunglasses be worn to avoid snow-blindness (e.g., 105A, 109A).

Information on body build is not clearcut. There are some indications that obese individuals may suffer from extreme cold to a greater extent than individuals with slenderer body builds. If this is true, probably the main contributing factor relates to the greater amount of skin surface served by the peripheral vascular system in these more corpulent individuals, and the correspondingly greater drop of surface skin temperature over this wider area. Mesomorphic (muscular) characteristics are reported desirable (93A). The big, tall individual is occasionally reported as not being as effective as the shorter (average height) person, for land operations, because the larger requires more food, to get the same work output (interviews).

For air operations, one source states personnel for parachuting in the Arctic should be at least 5'9" tall, and should weigh over 150 lbs, they should score over 100 on the AGCT, and should be carefully screened for psychological defects and past disciplinary record (interviews). These selection criteria for paratroopers are not necessarily unique to the Arctic.

Dental requirements have not been consistently stated. The effects of extreme cold upon metal has caused fillings to contract and come out, according to some (189). Others claim that when this occurs, it is due to poor dental work and is correctable before arctic assignment; they also indicate that the temperature within the mouth (as compared to outside) should not drop severely, and they report arctic operations which have not had any unusual number of dental problems (interviews).

2. Intelligence, Abilities and Job Skills in Relation to Selection

There are no reports providing correlations of any measurements of abilities with job performance or adjustment under arctic conditions. The minimum acceptable levels of skill needed in selection for the Arctic, as compared to other areas of operation, is not reported. There is no question that the more highly skilled are desired, but this is neither unique to the Arctic nor necessarily realistic in terms of over-all manpower selection problems.

a. Intelligence

For ship operations, the consensus is that beyond that normally done by the Navy, selection in terms of intelligence is not required. For land operations, selection procedures which screen out those who are extremely below- or extremely above-average have been suggested (interviews). Some state that above-average intelligence is desirable, or even necessary, for men who must perform under (land-based) arctic conditions (184A, 192, 93A). It has also been pointed out, however, that the very much above-average man may tend to take on too much work, and then try to live up to his reputation (interviews). The definitely below-average individual is reported as more handicapped in the Arctic than elsewhere because of the consequences of being unable to meet and adjust to the severe conditions (interviews). Another view, however, is that the person of below-average intelligence, if he is a well-integrated person, is likely to perform well in the Arctic when compared to the more intelligent but less stable person (71). One report sets an AGCT score of 70 as the minimum (119A). Another report, however, sets 100 as the score below which an individual will not be able to protect himself (93A).

b. Job skills and abilities

Selection (as well as training and performance of billets) for the Arctic can be dealt with in terms of the billets themselves or in terms of the skills (e.g., dexterity) which make up these billets. Although these approaches overlap, arctic selection problems can be mentioned for both.

1) Billet and duty selection: ship operations

For those special job skills involved in navigation, selection is reported as essential (interviews).

Special selection for those in command of the ship is reported as necessary with previous Arctic experience playing a major role (interviews).

Some feel that on ship, there is a certain amount of "natural selection" of billets by the men themselves in trying to get jobs about ship that they like; thus, unique selection for billet performance is not advocated if proper arctic orientation is given (interviews). (There are no systematic data which would either confirm or refute these views.) Individuals should be selected who have some other prior (to Arctic) ship experience. The men should have had some opportunity to perform their billet duties, particularly above-deck, before arctic conditions are encountered (interviews).

2) Selection for skills

Men selected should be fully trained and highly skilled in their specialties (93A, 92A). Usually neither the time nor the facilities exist in the Arctic for on-the-job training (interviews), and only the most skilled, persistent personnel are able to maintain the high standard of performance necessary under cold stress (93A). Men selected should be used to working with their hands (92A) and should have mechanical aptitudes (93A). Communication skills should be highly developed for those needing them (93A).

Another source sets a minimum score of 80 on the Army Mechanical Aptitude Test (interviews). Individuals with experience in operating under cold conditions have frequently had the opportunity to acquire skills in the operation of equipment, self-maintenance, and a knowledge of how to deal with arctic problems.

Other sources, however, say that specific selection for arctic service is not necessary, stating that any individual who is physically and mentally capable of adjustment to military life anywhere overseas is also able to adjust to life in the Arctic (22).

3. Personality Characteristics and Selection

The need in the Arctic for personal stability, as well as for some specific personality characteristics, and background factors have been reported by various sources. These same characteristics, however, are also reported as important for persons who are to be isolated, or under stress in other geographic areas or situations.

Data do not exist on the uniqueness of personality characteristics (for arctic service). The discussion below reflects opinions and judgments rather than measurements.

a. General stability

In general, men selected for polar service should have well-adjusted, well-integrated, emotionally stable, and psychologically "normal" personalities (71, 183, 50, 132, 165, 93A, 192, 16, 102A). Successful arctic performance correlates well with prior history of emotional stability and a good military record (83A). Men with major personality problems or psychiatric disorder histories should not be selected (50, 16). A "normal" score on various psychological tests is a good selection criterion, according to these sources, although more information is needed on this. Another source, however, states that personality "type" in itself does not appear to be related to probability of success or failure (183). The even-tempered individual with a "flexible" personality and a sense of humor is reported as desirable (interviews).

The need for a stable person is not reported as unique to the arctic areas, as compared to other extreme geo-climatic areas, e.g., desert,or to military situations in which the stress on the person may be great. The usual process of selection would be appropriate for routine arctic ship operations. Special selection for the determination of stability might be appropriate if the operation plans were to involve the ship's being "frozen-in" for the winter (interviews).

No particular type of individual was reported consistently as likely to "crack-up" in the Arctic who might not "crack-up" any place else when under stress (interviews). Men who have disciplinary records should be carefully screened (165). The appropriateness of applying the screening methods used for submarine personnel has been mentioned as worthy of study (interviews).

b. More specific personality characteristics

Particular personality characteristics have been reported as desirable, or undesirable for men who are to serve in the Arctic. One source considers the "ideal" arctic man to be one who enjoys adventure and the opportunity to use

ingenuity, is cheerful, can get along well with small groups, and has high intelligence and a well-integrated total personality (192).

An individual who has an adventurous spirit and who views the undertaking as of importance to himself, with a real desire to accomplish his duties, accept hardships and inconveniences in good spirits, is considered desirable by one civilian technical recruting group (interviews). Honesty and "good-sportsmanship" are reported as necessary (interviews).

Psychological test items dealing with reaction to monotony, work and sleep rhythms, lonesomeness and homesickness, adventure, travel, interest in novelty, resourcefulness, personality integration, self-sufficiency, and life interest are reported to be related to successful arctic performance (165).

One source lists tentative test items which may go with successful adjustment to the Arctic as: athletics, gambling, outdoor life, getting along with people, monotonous activities. Probable items which go with unsuccessful adjustment were listed as: country life, western life, carpentry, collecting activities, going one's own way (15A).

Younger men who had apparently not established definite sex patterns were reported to be more content with isolated duty than married men, older single men, or younger men who had formed definite sex habits (157A). Men strongly attached to their families don't adjust well; single men who have not made emotional separation from home, or married men who cannot endure separation from wife and children, have difficulty in adjusting to the Arctic (16).

Individuals with any feelings of agoraphobia (fear of the open and the unlimited horizons) or who would have strong feelings of being trapped if out on a cloudy night with heavy fog and low visibility are undesirable (interviews).

The individual with only one main interest is not as successful as those with two or three interests. Men with several interests of a sort which can be pursued or developed in the Arctic are desirable for selection (interviews). This is, of course, different from the encouragement of interest in arctic affairs.

c. Volunteers for arctic duty

There is some controversy as to whether or not volunteers are necessary, or even desirable, for land-based arctic operations. Two sources say that only volunteers should be sent to the Arctic (178A, 187). Another (anecdotal) source cites the cases of two men who did not volunteer and who, nevertheless, performed excellently in the Arctic (183). However, men should have goals

and an over-all interest in the mission (192).

Some of the reasons for which some men may volunteer for arctic (civilian) explorations have been reported as possibly being of negative value rather than positive. A man with a desire for publicity concerning "heroism" and a person with an "extroverted" approach who is looking for glory and acclaim are not the characteristics which are appropriate for the conditions imposed by the Arctic (interviews). This is not meant to indicate that other persons may not have other reasons for volunteering which would contribute to effective performance.

One study does indicate that the best predictor of later success in an arctic assignment was simply to ask a man whether he wanted to go (93A).

d. Background characteristics

In a study of men who did or did not plan to settle in the Arctic when released from military service after World War II, age, education, marital status, and rural-urban background were found not too different in the two groups; the proportion of prospective settlers was, however, highest among men from the Far West and least among those from the East (126). Men should originate from a small community (93A) and should not have strong home ties (92A).

1) Geographic background

Successful land and ship operations have occurred with men from all areas as part of the group (e.g., icebreaker operations) despite the host of ideas offered as to those who are best suited.

The part of the United States from which an individual originally comes is variously reported as affecting his performance. The points of view reported are that:

> The man from the northern states is desirable for the Arctic since he knows the problems of cold. However, in his home environment, he generally has a heated shelter available; he may also be overconfident of his ability to deal with cold conditions of a sort that he is not used to. The man from the South may have had less earlier acclimatization and greater fear of the cold; however, he may accept training more readily (or eagerly).

The person from rural areas is thought to be more self-sufficient and used to adapting himself to environmental conditions; he may be more accustomed to moving in darkness and not as afraid of being lost. The urban person, it is reported, may have fewer interests of the sort which would be satisfied in the Arctic (interviews). These points are generally made in connection with land-based operations.

2) Personal background

Concerning background characteristics, men should have a minimum of 12 months' military service (93A). The problem of length of previous service, during which time many adjustments (including job performance) can be going on, is complicated by the fact that many of those who might serve in the Arctic may be draftees who will not be in service long enough to be of value (for long-term land operations particularly) after they have obtained some military experience. Twelve months of service is reported as needed before selection for the Arctic (interviews). A personnel selection policy which will best assure continuity is also reported as desirable.

The need for selecting those with previous experience in cold, as advocated by some, is related to the problem of their availability, of acclimatization, of orientation, and of the nature of operation and the job to be done by the individual.

e. Leadership selection

There are no reports providing data on either the leadership techniques or the characteristics of good leaders in the Arctic differing from those considered good leaders elsewhere under other stress (or even non-stress) conditions.

The material available on arctic leadership stresses the importance of good leadership but does not specify unique arctic requirements. Reports say, for instance, that leaders should be carefully selected (35, 93A); they must maintain a high standard of leadership and discipline, ingenuity, intelligence, initiative, and knowledge (35, 93A). Army manuals indicate that initiative, endurance, and unselfishness are needed, and the caution is given to be a "leader, not a driver" (119A). There is, of course, specific Arctic information which the leaders must know. Previous polar experience, in less responsible positions, is considered very important, particularly on such ships as icebreakers. Among the men, confidence in the leader is partly contingent upon the confidence that he can cope with problems which arise as a result of arctic conditions. This need for confidence by the men, and for specific information by the leaders, is not unique to arctic operations even if they require specific information.

B. ORIENTATION AND INDOCTRINATION

Before personnel are assigned to the Arctic, they need some orientation and indoctrination. This is clear from written reports and from interviews with men having extensive arctic experience.

Nature of Information on Orientation and Indoctrination: No experimental information on the effectiveness of polar orientation and indoctrination has been found. A number of indoctrination manuals exist, e.g., Navy, Army, Canadian Instructor's Notes on Winter Warfare, (119A, 100A). Published reports may give some information on the arctic training which personnel received before or during specific operations. Evaluative data are not available on the extent to which given orientation procedures were or were not helpful, or the specific sorts of information which were or were not needed.

There will be no attempt in this section of the report to summarize all of the material available in published training manuals. The literature summary will attempt to classify some of the general problems which have been reported in connection with indoctrination, and to provide illustrations as they have been reported for some of these problems.

The materials in the other sections of this report on selection, job performance, morale, and adaptation relate closely to the information indoctrination.

Relationship of Indoctrination and Selection Problems: The amount of indoctrination needed will depend upon the personnel who are selected for arctic assignment. Indoctrination requirements will, of course, be greater for men with no previous arctic experience. The need for specialized selection can be decreased and, according to some, eliminated if effective orientation procedures are used (interviews).

Future military demands may readily exceed the supply of arctic-experienced men. The use of special procedures for selection among inexperienced individuals poses many problems of cost and of feasibility for military operations. Much emphasis has therefore been placed by many upon the orientation of individuals not specially selected for arctic duty. It is recognized that indoctrination and previous experience are not equivalent. It is also obvious that any individual, at some stage, has had no previous experience and must receive orientation.

Relationship of Indoctrination to Job Performance, Adaptation, and Morale: The content of indoctrination procedures relates directly to the job performance, self-maintenance, and morale of men who are to serve in the Arctic. Some of the available indoctrination material, therefore, appears in various sections of this report. The indoctrination information summarized here deals with: (1) the skills involved in the performance of billets or jobs; (2) living under arctic conditions; (3) attitudes toward arctic conditions. Again, as in the other sections of the report, there is more information available (reports, manuals, etc.) on experience with land than with ship-based operations.

1. Indoctrination for Skills Involved in Billets or Jobs

a. Ship operations: Duties or billets requiring special arctic indoctrination

1) Command duties

Great stress has been placed on the need for those with major arctic command responsibility (e.g., the Commanding Officer or the Executive Officer) to have both arctic indoctrination and previous arctic experience (in non-command positions).

The necessity for arctic experience, and not just indoctrination, has been reported (interviews). The presence in one ship operation of a commander with experience in arctic waters was of very great assistance (113).

2) Navigation duties and ice seamanship

The Navy Manual of Ice Seamanship contains much indoctrination information (109A). However, actual experience is reported by some experts as essential for those responsible for navigation (interviews).

Aboard ship, when navigating in ice, it is necessary to maintain strict watches to avoid ice whenever possible and, if it is required to enter ice areas, to select points of entry where the ice is least liable to do damage. This type of ice seamanship would indicate that the special ice watches, helmsmen, deck watch officer and all other duty personnel who have responsibilities related to navigation need (and apparently receive) special indoctrination.

Aboard icebreakers, specialized techniques are required to open paths through the ice (172A). Lead ships in convoys clearing their way through ice must consider the capabilities of the ships following them. Those responsible must consider their speed, the maneuvers they make, and the amount of clearance afforded through the ice. They must be aware of the operational limits of the following ships. Thus, the officers who will be responsible for most of these decisions must be well schooled in the characteristics of the various ships in the convoy (interviews).

Aircraft pilots operating with ships in scouting ice conditions, whether by helicopter or by long range patrols, must also be familiar with maneuverability, speed, etc., of the ships for which they are observing.

3) Below-deck duties

For ship operations, it is generally agreed that no special arctic training is needed for the performance of below-deck duties (interviews). The performance of these duties in arctic areas (as pointed out under Job Performance) does not differ to any major extent from their performance in other areas. Any special training for below-deck billet performance is therefore reported by arctic experts as not needed.

4) Above-deck duties

The performance of above-deck duties is affected by arctic conditions (see Job Performance Section). (Some of the information summarized for these duties is equally applicable to land-based operations.) Personnel who have received little systematic indoctrination for arctic performance are considered to be less effective than those who have received some orientation (interviews).

a) Job indoctrination and clothing problems

No reports are available which indicate the extent to which training with protective clothing will improve work performance above decks. One study on this problem has been a laboratory experiment (96). In this experiment, groups of individuals were trained in the operation of radar sets, radios, and switchboards while wearing arctic gloves and clothing in a warm temperature. They then were placed in a cold environment and their performance using the various pieces of equipment was compared to the performance of a second group also working in a cold climate, but who had not received the previous training under warm conditions. The results indicated that, while both groups showed a decrease in their rate of performance while working under cold conditions, the group which had been trained with gloves on

showed a significantly better level of performance than the group which had not received this training.

b) Handling problems

Personnel working above-decks may expect some problems of handling materials subjected to extreme cold. The Navy handbook (109A) lists a large variety of materials such as rubber, neoprene, fabrics, nylon, steel, etc., which will be effected by cold. Indoctrination on the effects of this extreme cold on the "elasticity, durability, strength, and other physical characteristics of these materials and the treatment they should receive" will be necessary (180A).

c) Maintenance problems

Personnel in billets of a skilled or technical nature may be required to make repairs which would not be usually encountered. The relative isolation of ships from logistic support, especially on long voyages, indicates that when replacements are not available, improvisations and substitutes must be provided. Electronic and radio parts appear to be expended at a higher rate while in polar zones than under normal conditions (109A). The personnel responsible for maintaining this equipment will have to be sufficiently skilled in their trade to make substitutions. Reports (134A, 109A) indicate that equipment taken indoors often will have moisture form on its surface and, if it is later exposed to the cold, this moisture will freeze causing failures and breakages. Electrical equipment used under the above conditions may also be expected to corrode. Unique maintenance requirements of equipment peculiar to cold weather such as starting engines, caring for batteries, winterization of equipment and the proper use of oils and lubricants will also be added to the responsibility of maintenance personnel. Since it is reported that special portable heaters of various types are used in many instances to start engines, maintenance personnel should also be familiar with the principles and care of these additional units.

d) Supply operations

The problems of supply operations appear to relate for the most part to the loading, unloading, transportation and moving of supplies off the beach areas. Since conditions and facilities in unloading areas appear rather primitive, a certain level of skill would be required for personnel involved in this type of operation. On some of the earlier supply expeditions to Point Barrow, personnel were relatively untrained in stevedoring work and inefficiency resulted. As time appears to be a crucial factor in such operations, this reduction in

effectiveness becomes important. Later supply expeditions to Point Barrow have used trained stevedoring seabees and engineering crews, with apparently satisfactory results (137A). The extent to which these units were given previous training under conditions similar to those found in the operational area is unknown.

b. Land or shipboard operations: Indoctrination for some job performance problems has been reported which does not specifically relate to ship operations. The following types of duty have received mention as appearing to require special indoctrination.

1) One of the most crucial duty performance areas requiring broad training centers around vehicle maintenance and vehicle driving. It is reported that these men should be taught every shortcut and "trick of the trade" (90A). Reports indicate that drivers should be trained in maintenance of vehicles, recovery and rigging of vehicles, problems of batteries, fuels and lubricants, convoys and "cat" freighting operations, heaters and theory of cold weather starting, winterization kits, and arctic storage (92A, 107A). This type of training appears to be necessary due to the wide variety of servicing jobs which may be expected to arise while driving.

Mechanics may at times be required to work in maintenance sheds that are poorly ventilated and at times quite cold. Work schedules should allow for some loss in effectiveness. One report suggests that for trial operations special platoons be formed, trained in driving, mechanics, etc. This team should include clerks, welders, blacksmith, carpenters and motor mechanics (133).

2) Communications and radio personnel are also reported as requiring additional training (109A, 105A). Recommended training for these billets should be aimed at preparing personnel for the cold weather operations of shore stations, where antenna design, direction and matching, and a knowledge of how to choose frequencies and power are extremely important (189). In addition, it will probably be necessary for communications personnel to be skilled in making outside repairs in case of damage to antennae, power plants, etc.

3) Special problems of preparing food, the lack of adequate water supply, and packing food so as to have it retain its warmth, indicate that mess personnel require special training. It has been suggested that cooks should be taught the care and maintenance of gasoline stoves and unit cooker repairs under arctic conditions (107A). On one amphibious operation (138A) mess personnel were not adequately trained to work under field conditions with the result that food was poorly prepared and distributed and dishes were not washed properly.

4) One operational report suggested that training of medical units should include all training given to men (such as skiing, bushcraft for land units, etc.) plus a thorough training in special medical problems that will be encountered. Also, every medical officer should know the principles of navigation and radio operations including the ability to receive and send CW messages since at times he may be the only officer on a rescue party (189).

5) Special engineering problems may be expected to arise under conditions of extreme cold and for which personnel should receive preparatory training. One report suggests that engineers should receive special training in clearing snow, problems of winter camouflage, techniques of ice crossings, and methods of use of available water supplies. Personnel holding billets in special civil engineering jobs will have to develop techniques for surveying and allied work (107A).

c. Air operations: As is stated in the section on Job Performance, literature reports tend to minimize problems peculiar to polar flying.

1) Maintenance

An analysis of problems dealing with flying in the Arctic reveals that 80-90% of these problems were in the area of maintenance. Further, this record analysis indicated that maintenance man-hours increased five times when the temperature was at minus 40 degrees than when at plus 30 degrees (170A). Another report indicates that ground crews will be responsible for using special equipment to clear snow and maintain special cold weather equipment (167).

Because of the large increase in maintenance problems, pilots as well as ground crews should receive indoctrination and be familiar with aircraft maintenance (170A). Another report also indicated that such training is necessary, and especially recommends that the pilot become familiar with his own plane's de-icing and oil dilution systems (168A). This recommendation, according to recent reports, has been carried out.

2) Navigation

Navigators and individuals responsible for navigation aboard planes should be indoctrinated in grid navigation (177A). Because of the difficulties of navigating by instruments due to deviations of standard compasses, it is deemed necessary that personnel should be thoroughly taught in systems of navigation which are applicable to polar zones.

It was reported that plane crews were at times reluctant to fly due to their lack of knowledge of navigational techniques needed in the Antarctic (168A).

One of the missions of flights in both the Arctic and Antarctic will be mapping of terrain. In order to fulfill these missions effectively, pilots will require some additional training in aerial photography prior to undertaking such missions (178A).

On one operation a lack of training in this area resulted in a lack of teamwork between the pilot, co-pilot and navigator in accurately observing terrain (104A).

Due to the small size of some of the airstrips at which pilots will be required to land, the Arctic Training School for air rescue required that pilots practice landings and take-offs on small and short landing strips (111A). Also practice was provided in ski and jet assisted take-offs to familiarize pilots with them.

2. Living Under Arctic Conditions

Great stress is placed by most sources upon the importance of orienting men properly before they are exposed to extreme cold conditions. Arctic manuals, both Army and Navy, deal with the hazards of frostbite, snow blindness, touching metal, and other self-maintenance questions (109A, 115A).

Material on indoctrination is summarized below concerning (1) principles of body maintenance; (2) health and arctic injury dangers; (3) clothing. Depending upon whether ship or land-based operations are involved, the problems reported on orientation for self-maintenance differ in some ways. Orientation problems for arctic living will thus be considered specifically for shipboard and land-based operations.

a. Information on body maintenance

The arctic is friendly only to those who know how to deal with it. Reports on observations of the problems encountered by the troops in Korea indicated that the men were not oriented sufficiently on problems of extreme cold (non-Arctic) conditions, even though much information exists which would have been helpful (interviews).

Personnel should be taught the basic principles of the production and preservation of body heat, the value of insulation and the dangers of perspiration. On one operation numerous conferences were held aboard ship with talks, slides and pictures to illustrate these principles (189). Information must

be given on "windchill" so that men realize that it is wind and cold, not cold alone, to which they must adjust. The men should understand why (although not in great technical detail) certain actions are needed in order to adjust, not merely what actions to take.

b. Clothing

Indoctrination is, and must be, given in developing skills in the use of arctic clothing to the best advantage (interviews). However, the type of training that is required in this instance should not be misunderstood. It is not merely developing accustomization to wearing these clothes, but developing an accustomization using these clothes as needed in the field (e.g., the removal of excess clothing during heat-producing activities). Improper choice of clothes and carelessness accounted for 1/3 of the cases of frostbite (93A). Many of the reported failures of clothing and equipment were due to poor training in using these items (192). Even for troops who had been given extensive training in the use of clothing and equipment, it took time for some individuals to adjust themselves properly, and appreciate the items issued.

c. Health and arctic injury dangers

A lack of orientation on the dangers of frostbite and snowblindness and of the means of protecting oneself from these and other damages may cause disruption to operations. One observer suggests that individuals should be trained in attentive consciousness, sensory discrimination and alertness to feelings of frostbite. He further suggests that they should experience or be made aware of the harmful effects of fatigue, alcohol and hunger in masking the cues of frostbite (165).

Topics such as the nature of cold injury, how long it takes to be frostbitten, and what to do in case of cold injury are covered in manuals, instructors' notes, etc. The problem, according to one observer is getting this information to the men who need it (as in Korea) (interviews).

Training in frostbite prevention resulted in very few cases of frostbite, according to one operations report (107A).

d. Shipboard operations

Emergency survival problems differ from those which can be dealt with in orientation on physical protection. For Navy operations, indoctrination is essential on how to try to survive should the men be forced to abandon ship. The problem of the limited time that one can survive in arctic waters is

reported as one which cannot be solved by indoctrination, although the men must know any information which is available.

The fact that, under normal operating conditions, the men on a ship have a warm environment with them below decks means that indoctrination for ship operations can be less extensive than for land operations (interviews). Men going back and forth from the warm (below deck) to the cold (above deck) environment have to be oriented as to the adjustments which need to be made (interviews).

e. Land-based operations

The problems of adjusting satisfactorily to polar conditions are greater for land-based operations than for shipboard. To meet these problems, land units prior to and while in the Arctic carry out more elaborate and extensive training programs than are carried out prior to sea operations. The types of training emphasized stress both techniques of self-maintenance and of survival. This training is not felt to be inclusive but rather is expected to establish certain skills which actual experience in the Arctic will facilitate.

A large variety of skills related to self-maintenance and survival are taught at the various training courses conducted by the Army. The skills taught by the Army Indoctrination School at Big Delta, Alaska, are fairly representative of most training courses. Subjects taught there include:

- Alaskan Geography
- Weather and Climate
- Use of Cold Weather Clothing
- Use of Sleeping Bag
- Cold Weather Supply and Logistics
- Preventive First Aid
- Ski Trains, Ski Marches, Ski Joring
- Land Navigation
- Care and Waxing of Skis
- Snowshoes
- Oversnow Vehicles (weasel, penguin, etc.)
- Sleds, loading, lashing
- Tents, Stoves, Rations, Backpacking
- Lean-to's
- Fire Bivouacing
- Snow Caves and Igloos
- General Bushcraft

Other areas of training stressed by the Arctic Training School were designed to teach pilots survival techniques in case of forced landings and also air-ground coordination for logistic operations. The Training School recommended briefings once every three months on emergency and survival procedures for all pilots flying in the Arctic. Special air rescue crews were trained in woodmanship, camping, hunting, skiing, navigation, pilotage and dead reckoning, and air search patterns (111A).

The Germans during World War II established weather observation stations in arctic areas. The weather groups were trained first in specialist training and then in other maintenance. (It was also mentioned that attempts to accustom personnel to tinned food to be used later was a failure since it "bred a premature dislike" (55).

3. Attitudes Towards the Arctic

Various facts and fables will affect the feelings and fears of individuals concerning the Arctic. Indoctrination on billet performance and self-maintenance is not only a question of conveying information, but also of influencing attitudes.

a. Attitudes held by the men before arctic service

There are problems of indoctrination in relation either to the over or underemphasis which men place upon arctic hazards.

The cold of the Arctic is so well known, according to one report, that its effects are more likely to be overrated than underrated (181). Another indicates that the newcomer at Fort Churchill, Canada, tended to be overly impressed with the difficulty of northern operations. He tended to feel that he could not survive if he lost contact with his companions (115A). However, others have reported that at times the younger personnel in polar areas tend to disregard the proper principles of protection, feeling that they are unnecessary. Some men tend to face short-time exposure with careless attitudes (192). Field training, some feel, should be so designed as to make men want to go to the Arctic. Some attempts have been made to more directly motivate men through series of lectures and movies concerning the Arctic. Dangers of this type of indoctrination lie in the tendency of some lecturers and movies to over-emphasize the extreme dangers of the Arctic, rather than emphasizing normal living. In one Army exercise, it was reported that this mistake was made. However, the Canadian Army, in training men for polar duty, attempts to promote the idea of hard living and self-sufficiency. They felt a certain amount of prestige went with the idea of being able to take rugged duty (167).

The value of training is greatly accelerated when the trainee realizes his own inadequacies in certain areas. Under these conditions, the individual himself wants to increase his knowledge rather than being "motivated" by fiat. Morale surveys during the last war indicated that the longer personnel were stationed in the Arctic, the greater was their desire for additional training (123). While to some extent this desire for additional training may have been a desire to escape from everyday routine, still it also appears that the greater range of problems accompanying work performance also

contributed to this desire for increased training. Both officers and personnel need to realize that a warm climate work-schedule cannot be adhered to. This is especially true of personnel first arriving in polar climates. Reports of personnel attempting to meet such schedules usually include indications that the men felt exhausted. Further, there was a concommitant drop in their confidence in themselves and belief in their ability to remain healthy and function effectively under conditions of cold stress.

Official training publications have tried to show how to cope realistically with arctic conditions. The Army's arctic manuals, for example, have not minimized the hazards which will be encountered. But they also point out (at the beginning) that the dangers of the sub-arctic and Arctic are exaggerated in the movies and in popular fiction (119A).

The difference in the nature of contemporary military operations -- particularly those of the Navy -- from the expeditions of the arctic explorer is felt by some to explain the inappropriateness, today, of excess fear of the Arctic (interviews). Contemporary indoctrination stresses the view that men can handle the problems which arise without minimizing the importance of the problems. Orientation can tell the men what they will see and what the problems will be.

For ship operations, the aim of indoctrination is to foster the view that the men can live on ships under any conditions, and that ships are constructed for that purpose. It has been pointed out, for instance, that conditions may be as severe in the North Atlantic in winter as in arctic waters (interviews).

b. Attitudes during arctic operations

1) Ship operations

Many of the attitude problems (as discussed in the Morale Section) apply more to land than to ship-based arctic operations. Many experts feel that problems of isolation, recreation, etc. are not unique to the Arctic for ship personnel.

Orientation should try to provoke interest in the Arctic, its geography, native people, varied ice conditions, geology, etc. (interviews). Confidence in the leadership of the ship, and in their ability to deal with problems, is stressed as being even more important in the Arctic than elsewhere (interviews). However, the need for these attitudes toward the leaders is not just an arctic problem. It involves no unique arctic orientation for the men, although it requires unique arctic information to be held by the officers.

2) Land-based operations

The orientation concerning attitudes for land-based arctic operations involves more unique problems than for ship-based. First, on a ship, as pointed out, there is a warm environment below decks. Second, recreation and morale facilities exist on shipboard as in other areas. Third, the isolation aboard ship is not unique to operating in arctic waters. Fourth, the isolation of the crew aboard ship differs from that on land-bases. Each of these factors involve certain additional attitude orientations for land operations. The problems relating to morale orientation (as pointed out in the Morale Section) are those of the isolated base, and are not applicable only to the Arctic.

The added emphasis placed upon the process of group living in polar regions has received recognition by the Army and training for exercises and maneuvers in arctic areas often stresses this factor. During the training held prior to one exercise, one of the objectives was to teach the personnel small unit operations and leadership (167). Towards this end the "buddy system" was encouraged, units were housed together in tents, and small units were expected to work as teams while in the field. It was felt that this type of training gave the men confidence in themselves, in their fellow team members, and in the equipment that they were to use. They all worked under, and shared, the same hardships thus encouraging a bond between the men.

4. Methods of Arctic Indoctrination

There are comparatively few unique arctic problems concerning how indoctrination is to be conducted. Most of the methods questions relate to where the men should be taught. What the men are taught must, of course, be specific to the Arctic, and to the type of operation involved.

a. The location of indoctrination

There is general agreement that, under cold conditions, some accustomization does occur (see General Reactions). There is some question as to whether or not some experience or indoctrination under cold conditions is necessary, and not merely desirable.

1) Ship operations

The view is generally held that ships (e.g., icebreakers) have successfully operated even though many in the crew had no prior indoctrination under cold conditions (interviews). No data is available comparing the operational effectiveness of groups which had received training in cold conditions and groups which had not.

2) Land-based operations

One report indicates that past maneuvers and combat (land-based) show the need for prior training under extreme cold. Men taking cover were found to be slower under cold than under temperate conditions in one training exercise (115A). The view is that the only way to develop acclimatization is by experience and gradually increasing activity in the environment (152A). This training is also felt to help eliminate those obviously unfit for cold weather duty.

Some reports indicate that pre-arctic training to be realistic should take place in an area in which the temperature gradually decreases from mild to cold over a period of approximately two months. The northern part of the United States is felt to best approximate these conditions (94A, 50, 95A). The training that is carried out at these centers in most cases is of an advanced nature and assumes that personnel have already completed their basic training and are well oriented towards military procedures. The basic aims of this cold weather training is the development of specialized skills necessary to function in the Arctic, rather than an indoctrination into military life.

The Army has developed and is using an indoctrination school located at Big Delta, Alaska. While no data is available as to the relative worth of training in Alaska as against preliminary training in cold areas within the United States, e.g., the camps in Colorado, it appears from reports that this permanent installation is well suited to teach those skills necessary for personnel who are to be stationed in the Arctic. Temperatures in the area around this school range from -60 degrees to +90 degrees with winds up to 60 miles an hour being reported.

While there are many obvious advantages to establishing training schools in polar regions, most bases may have neither the time, money, physical facilities, or personnel to undertake such efforts. It has been recommended that no attempts be made to give personnel on-the-job training due to a lack of time and facilities (interviews). Others feel that while such (cold condition) training is helpful, it is not essential. (They do not imply that orientation to the Arctic is unnecessary.)

b. Length of training prior to arctic assignment

While no experimental evidence is available as to the optimal length of training necessary, most reports state that training periods lasting from 6 to 12 weeks are sufficient (95A, 50). Of course, this length of time assumes that weather conditions will tend to be increasingly severe. Many times training

programs have been quite hurt by thawing weather which precluded personnel experiencing the effects of the cold.

This 12-week training period, aside from the development of specialized skills, has also several secondary, though important, aims. By allowing personnel to be exposed to the cold in ever increasing amounts, it is hoped that a certain amount of acclimatization will take place prior to departure for polar regions. Criticism was also made of giving men leave at the end of training in cold, before they leave for the Arctic. The acclimatization effects are lowered due to many who return briefly to warm areas.

Prior to one recent operation, 6 weeks of training was given in Colorado, which included both living and job performance. The three phases covered a basic orientation period including a phase involving self-maintenance, job skills, and actual field maneuvers under cold conditions.

In preparation for many exercises in the Arctic, training has often been divided into two periods. In one exercise the training of two months duration was given in a cold-wet climate (95A). Phase I lasted approximately six weeks and was designed to introduce troops into cold weather living. It contained at least three bivouacs of two days each. Phase II contained field maneuvers lasting at least ten days followed by a detailed critique. During World War II, the Arctic Training School at Buckley, Colorado, has a five-week course, the first two weeks devoted to arctic living and travelling, and the last three weeks to specific job skills (117). Army operations training manuals report twelve weeks as desirable and ten weeks as the minimum for training a regimental combat team (105A).

c. The instructors for arctic indoctrination

The desirability of using instructors who have themselves had arctic experience is apparent, but two questions arise: (1) Is it necessary? and (2) Will there be enough arctic-experienced instructors available? The amount of information on these questions is limited.

Providing qualified instructors is considered as the most critical problem in preparing a force for arctic operations (105A). No one lacking practical field experience in the north can appreciate the conditions and the measures needed to overcome them, according to Army Field Manuals (105A).

Whether enough instructors are available with appropriate arctic experience (land or sea) cannot be estimated here. Data are also needed to determine the effectiveness of non-experienced, but well-indoctrinated instructors.

d. Indoctrination techniques

The usual techniques (e.g., movies, lectures, manuals) have been used. The additional questions of technique relate to the previously considered problem of whether practice of skills (job and self-maintenance) under cold conditions is required. The views in this summarize most readily to the belief that such practice is helpful but not essential, if sufficiently thorough information is given on the problems of arctic work and living.

The need for objectifying the assessment of the training programs has been pointed out. Evaluation, through standardized methods, of the general effectiveness of training exercises and indoctrination techniques would serve a valuable function.

C. JOB PERFORMANCE

Working and living in arctic environments involves a number of problems not met in more temperate zones. No generalizations about polar living can hold without qualification; still, it may be expected that a certain loss in efficiency and a readjustment of working habits must occur in individuals experiencing the effects of cold. A considerable amount of research has been carried out on the nature of man's physiological responses to cold. Unfortunately much less is known about the effects of extreme cold upon a man's psychological reactions especially in relation to his ability to function well in the military as compared to a laboratory situation. This section will summarize what is presently known about the effects of cold upon the ability of men to work and fight.

Nature of the Data: The data on this important problem of working under extreme cold is frequently scanty and unsystematic. Operational reports may indicate the difficulties encountered, but these statements are often general in nature with very little attempt to report the problems found in specific Navy billets. This lack of specific information is not the fault of the officers compiling the reports, for special training in careful job analysis is required before it is possible to develop the specific information of polar effects on job performance. The data in the area of health problems is more clear-cut than in the areas of efficiency. Perhaps this clearer demarcation stems from the fact that reports on health are written by trained observers operating in their field of specialization. The effects of such conditions as skin lesions, dry skin, and frozen extremities will be examined only to the extent that they relate to a man's performance. A more intensive analysis of physiological problems will be found in the section on General Reactions to Cold.

1. Bodily Reactions Which Affect Job Performance

Job performance is affected by cold hands. On exposure to cold the physiological mechanisms of heat conservation (cf. General Reactions to Cold) favor the vital visceral centers; their temperature is maintained by allowing the extremities to become chilled (interviews). The skin temperature of the fingers drops rapidly when exposed to cold for a brief period, the amount being related to environment temperature and to wind speed (48). It may be expected that personnel who are constantly required to remove their gloves in order to make repairs may experience a gradually increasing sensation of numbness in their fingertips. This problem was alleviated to some extent in the operation (133) by directing warm air from portable heaters upon the exposed fingers of the working personnel.

Frostbite is one of the principal physical problems peculiar to polar climate. Toes, hands and face appear most subject to attack. Recommendations for guarding against frostbite, aside from those concerned with proper clothing, are given in most training manuals. Chapped lips, lesions of the skin, and other minor irritants may be expected to appear on personnel working aboard ships under conditions of wet-cold. It may further be expected that some personnel will experience minor abrasions about the hands and wrists due to the clumsiness resulting from handling and using tools under cold weather conditions. The use of dark goggles to guard against snowblindness appears to be quite effective. On recent naval operations there appears to be very little mention of injury due to this factor.

Aboard ships and possibly in well-insulated and heated barracks, the very low humidity may also cause dry throats and even bloody noses (171A). However, these symptoms do not appear to be too severe, nor to handicap performance to any great extent and seem to leave no permanent after effects. Aboard ship, reports indicate that the low humidity should cause more complaints along these lines than actually appear. It may be possible that this problem is minimized due to the humidifying effect of drying clothes left by the crews in their quarters.

2. Problems of Fatigue

Working under cold conditions produces fatigue effects. It is a common and reasonable assumption that men cannot resist the harmful effects of a cold environment as well when they are tired as when they are refreshed and rested. This section will place primary emphasis on these reports which shed some light on this important problem; specifically as it effects the working proficiency of military personnel. Separate consideration will be given to the fatigue reactions of men involved in active jobs; their problems may be different from the problems of personnel in billets which require relatively

little "outside" activity. Clothing, subjective feelings of cold, and resistance to fatigue are often reported to be separate problems for these two groups.

a. Dry cold (0° to 50°F), personnel active

Men who are physically active in dry cold experience fatigue more quickly than under standard conditions. They can be expected to require rest pauses more often. Laboratory experiments indicate that no more energy is required to maintain body heat balance under arctic field conditions than is expended under similar conditions in temperate climates (96). While this finding has not yet been substantiated by sufficient experimental data, it does indicate that the causes for the added increase of fatigue in physically active personnel may logically be sought in areas other than the energy needed for body heat balance.

1) Clothing and equipment problems increasing fatigue

Probably the main causes of fatigue in polar regions stem from the added difficulties associated with the methods used to protect themselves from the effects of cold. Some military observers (interviews) have felt that the increased number of routine tasks necessary, each requiring more time than under temperate conditions, keep men so occupied in simply caring for their own welfare that they have less energy reserves to utilize for their jobs.

Laboratory tests indicate that the bulkiness of arctic protective clothing increase caloric intake approximately 10% over what would be required to perform the same task using desert clothing (58). These results probably apply only to inexperienced personnel who have little facility in the use of arctic clothing. However, they do indicate the restrictions under which personnel may be expected to work. It often takes more time to get a job done in the arctic than elsewhere. Fatigue will thus be increased. For instance, manual dexterity will be effected by the haste of the personnel to put on their mittens. Bulky clothing and/or mittens will increase the difficulties of personnel in reaching relatively inaccessible spots in the equipment. In one operation, many hours were required to merely remove a carburetor (130A).

Active work in the open will result in perspiration starting to accumulate in the clothing. In order to guard against this, personnel must readjust their clothing to insure proper ventilation. While working in the snow tools will be dropped, lost, or broken due to the difficulties involved in handling them. In these cases time must

be spent seeking the lost tools or going for replacements. This interference with the work may be expected to increase fatigue.

2) Problems in changing thermal conditions which increase fatigue

It may be expected that all personnel will take advantage of heated shelters while resting. The warmed shelter, of course, will greatly aid the individual in restoring body heat, but at the same time the transition from extreme cold to a much warmer temperature will cause a certain increase in drowsiness and fatigue (152A). This reaction is specially pertinent to sea operations where it may be expected that, after a period on deck, individuals will take advantage of the relative warmth offered below decks. Thus, the detrimental effects of excessively warmed compartments, both in unfitting men for keeping watch in the cold later, and also in inducing fatigue drowsiness in other personnel engaged in tasks requiring powers of concentration or reasoning facilities, has often been reported (interviews). This matter may be of some importance. The British practice (interviews) in the past has tended at times to result in underheating of living spaces, while it is understood that Americans may have erred in the oposite direction, sometimes to a severe degree. It has been suggested that an approach should be made in obtaining a sound definition of the optimal conditions to be maintained in cold climates of varying severity, in sheltered positions, or below decks with men wearing appropriate clothing (interviews).

While much discomfort may be avoided by well-designed clothing or shelter, there will probably still be occasions, in the future, when men go below to compartments, which are only moderately warmed, after exposure for a considerable period to severe cold. Delay in warming up will undoubtedly reduce the beneficial effects of rest during the periods off watch, and it was suggested at one conference that special attention should be afforded to warming men up rapidly on these occasions either by the use of specially heated cubicles or rooms and hot drinks, or with hot showers.

The thermal conditions which may be maintained in a warship compartment to reduce these effects of drowsiness and fatigue (interviews) will vary with the severity of the external conditions and the amount of heating and insulation with which the compartment is fitted, provided that the ventilated system is designed on sound lines. The present practice in the Royal Navy in designing, heating and ventilating arrangements is to assume that the average outdoor temperature during "very cold weather" will be about 25°F, and under "arctic conditions," about 10°F. It is an essential preliminary to the

planned "arcticization" or "cold weatherization" of ships that the soundness of this assumption should be critically examined in the light of the purposes for which ships will be used, the areas where they may be expected to operate, and the time of the year when operations are likely to be undertaken. These conditions should be clearly stated if the necessary information is available.

b. Dry cold, personnel inactive

The problems facing personnel subjected to cold stress while remaining relatively inactive tend to be more severe and likely to produce fatigue more rapidly than for personnel engaged in some type of physical activity. Such duties as deck watches, lookouts, and surveying parties usually require less physical activity. It may be expected that a relatively inactive person, fully protected against the cold by arctic clothing, will not be able to tolerate extreme cold (with no wind) for longer than three hours (93A). On board ships underway, the factor of wind will reduce even this estimate considerably. However, in all cases it is doubtful whether personnel in such situations can actively carry out their duties longer than one-half hour to one hour. After this period, personnel will probably be too concerned with their own feelings of discomfort to function adequately.

Another probable important contribution to the increase in fatigue in inactive personnel relates to the passive state itself. An active person will require his attention be given to the task he is doing. Preparing a landing strip or repairing deck equipment, for instance, demands that the individual coordinate his activities towards carrying out the task. The severity of the cold and wind become factors which interfere with the manner in which he does his work, but the individual's main concern is focussed on accomplishing his work. On the other hand, the relatively inactive person may have his attention directed solely to the climate. In all likelihood, the discomforts of his position become emphasized all the more (interviews).

3. Specific Job Performance

This section is concerned with the effect of the arctic on particular types of jobs or billet duties. The data, at present, do not permit precise recommendations for each billet; rather the problems will be outlined and, in later sections, suggestions offered whenever the evidence permits. While the basic personnel interests of the three services are similar, there may be some differences of emphasis in naming the most urgent problems. Therefore, the present review will be primarily oriented toward Navy job requirements and then will touch on some of the Army and Air Force problems under arctic conditions.

a. Ship operations

1) Command duties

Special knowledge, experience and indoctrination are necessary for naval officers assigned to ships operating in Arctic waters. The responsibility to protect and guarantee the safety of his men is a necessary requirement of all officers, but it is especially important when men are placed under stress. The command and administrative responsibilities of naval officers does not, under normal circumstances, require them to perform for long periods in extreme cold. However, they must know how to do different things; they must in the opinion of many officers (interviews) command the respect of their men not on the basis of rank, but rather of greater information. It has often been recommended (interviews) that no officer be assigned to a position of major responsibility until he himself or his Executive Officer have been thoroughly trained in the command problems which may be specific to the Arctic. Any failure of the officer to provide correct information in a particular assignment will make the men suspicious of his judgment in other larger and more important decisions. Whenever men are under stress in an unknown and apparently threatening environment, it is absolutely necessary that they have confidence in the ability of their officers. While these are not uniquely polar problems or needs, the information to cope with these in the Arctic is specific to the area. It has been pointed out (interviews) that officers can help to create this feeling of competence and knowledge by becoming informed about the history of the region. They should know the interesting stories of the early explorers and also something about the "flora and fauna" of the terrain in which they are operating (interviews).

2) Navigation duties, ice seamanship, watches

Unique arctic problems exist for navigational tasks and watch duties as they apply to navigation. Weather conditions during the summer, in July, August, and September, when the ice has broken sufficiently to allow ship's passage, tend to be changeable. Offshore, sudden storms, ice, fog, rain and some snow will all tend to limit visibility. Since navigation maps in many regions of polar waters tend to be unreliable or incomplete, quite often navigation will demand great skill and reliance upon us of radar and the fathometer. Floating ice represents a possible source of damage to ships (109A). Navy operations handbooks warn that radar is not completely dependable, and ice watches are therefore absolutely necessary. Ships hitting ice will have ice fragments float under the ship and rise in the

vicinity of the propellers. Many ships have had broken or chipped propellers due to ice and rocky beaches. One ship (interview) damaged her starboard screw in this manner. In order to guard against this, there must be full cooperation from port and starboard propeller watches stationed on the wings of the ship. The Coast Guard icebreaker, Eastwind, revised normal watch procedures while going through ice and increased the number and station of watches in order to more fully guard against the ice. The ship's watch officer who is conning the ship, the helmsman who is steering, the fathometer watches and the lookouts must be organized into a team (172A).

Due to the added strain placed upon the helmsman, he has been rotated, in some operations, every 30 minutes (188). For watches in exposed positions, the length of the watch on various cruises appears to have been varied according to the severity of the weather. That is, one hour in mildly foul weather, and only 20 minutes in freezing weather (98A, 136A). (Frequent reliefs for warm drinks has been reported as having a tremendous effect on buoying up personnel.) It is not possible at present to recommend a specific length of time for watches which will obtain for all types of operations in arctic waters. For example, the effect of wind may be a deciding factor in determining the length of time a man can remain above deck, one report indicated that men can function above deck in temperatures of 10°F with no wind, but cannot work in temperatures of 25°F when the wind is 30 knots (174A). It has been found that when ships are being navigated by dead reckoning in polar waters the demands placed upon the deck watch officer increase greatly. On icebreakers, it has been found that the deck watch officer was best located on the wing of the bridge where he could observe the wake of the ship as a guide to the evenness of his course (172A). Many reports indicate that the deck watch officer's duties when conning the ship become increasingly strenuous and that extra officers are required to guarantee efficient operations. The deck watch officer should be free from matters of ship routine so that he can concentrate upon reports from watches, as well as providing needed emergency relief whenever necessary (178A, 172A).

3) Scouting duties

To a great extent there will be an increased dependence upon airplanes to scout ice conditions. In many instances helicopters and long range scouting planes will be based aboard ships. This necessitates an increase in plane handling and maintenance crews. Crews will have to be trained in the raising and lowering of planes over the side of the ships. Also, plans must be made for proper

coordination between planes and ships. Pilots and observers can give unrealistic reports on ice conditions due to their lack of information about the ship's capabilities. What appears to be a safe situation to the scouting pilot may, when accurately interpreted, be quite threatening to the ship's safety (178A). Further, reports indicate that at times lack of coordination results in planes giving misinformation on ice conditions to their own ships (128A).

4) Below deck duties

It is generally agreed that the men and officers functioning primarily below deck have few arctic problems when the ship is in extreme cold. It has been pointed out that to some extent men below deck bring their environment with them. Probably the only important problem is the necessity to define the optimal thermal conditions at which personnel will live comfortably and at which those performing skilled tasks will operate efficiently. The problem of over and under heating quarters as was mentioned in the earlier section on Fatigue is relevant to this discussion. The detrimental effects of excessively warmed compartments, in inducing drowsiness and inattention in personnel engaged in tasks which require powers of concentration or reasoning facilities, are generally appreciated. Unfortunately, however, the optimal conditions which one should attempt to maintain have not been defined for those who must live in artificially heated shelter in cold climates. In recent United States Naval Antarctic Exercises it was stated that the aim was to maintain the thermal environment in living compartments between 68° and 72°F, but in practice this was frequently not possible (interviews).

5) Maintenance duties

a) Maintenance crews (dexterity)

Maintenance crews experience much difficulty in keeping their fingers warm. However, some of the reports indicating great deterioration of personnel effectiveness may be somewhat exaggerated. Some observers report that maintenance crews working in cold of 30° below zero with gloves could work for only 10 minutes (119A) while other reports indicate that individuals can work for much greater lengths of time under much colder conditions. (The role of wind chill is not indicated.) Recent operational reports and laboratory experiments (interviews) indicate that cumbersome clothing and icy decks are more responsible for a slowing down of maintenance than the cold itself (109A, 173A). However, it is not known how much training in the

use of arctic clothing will reduce this loss in effectiveness. The loss of manual dexterity, resulting from the use of gloves, may be seen in reports that maintenance crews cannot complete their work on schedule with gloves, or else they rush and do an unsatisfactory job in order to put their gloves back on again. One laboratory study (21) investigated performance on a standard motor skills task with and without gloves at 68°F and at temperatures down to 42°F with unspecified wind velocities. He found that in a moderately cold environment performance without gloves is greatly superior to performance with gloves. Clearly then, the gloves interfered more with performance than they protected the hands from the effects of cold. However, it is true that in extreme cold, fine manual manipulations sometimes required by maintenance crews are not possible for more than a short period. It has been recommended (interviews) that, during the time when fine manipulations are necessary, an outer mitt with a high insulating value be removed while the operation was carried out by the hand protected by a well-fitting silk glove. In this way otherwise impracticable jobs might be undertaken with ease and without discomfort.

b) Other maintenance crew problems (additional personnel requirements)

Aboard ship conditions will be fairly crowded. In part, this will be due to the increased ship complement -- observers, cargo handlers, flight crews, etc. Living conditions may accordingly be expected to suffer. Bunks and mess facilities will be crowded, and,on one operation, over crowding decreased the amount of water available, limiting showers to one a week (178A). In some cases crews' quarters will be untidy due to the lack of storage space for winter gear and the necessity to continually dry out wet clothes (178A). It may further be expected that extra demands will be placed upon laundry facilities and laundrymen will have to be versed in special methods of cleaning arctic clothing. In cold weather ships may expect icing of decks, exposed equipment and superstructures. Spray in heavy seas will contribute greatly to this factor. While standard practices for removing ice (warm salt water, chipping, solvents, etc.) are fairly satisfactory, it should be expected that heavy icing will place extra demands upon personnel who will be required to remove the ice and snow. This extra exposure to the elements will add to their fatigue. The increased demand for weather reports appears to necessitate the assigning of one or two radio men to the sole duty of copying weather schedules. On one operation, the three aerographers

mates found that they could not carry out all their assigned duties, and at least one extra man was needed (173A).

c) Equipment maintenance problems

Since it may be expected that equipment and machinery exposed on the deck in temperatures below 10° will experience some failures and malfunctionings, added component parts need to be carried. Thus, instead of having to effect repairs in the open, maintenance crews can shorten their exposure time by merely replacing the defective parts. When metals and metal equipment are brought indoors from a cold to a warm environment, moisture will condense, and if they are then taken to the cold again, freezing will take place (109A). In many cases this will jam equipment and require extra repair time.

In all probability various classes of ships will experience the same weather differently. For instance, large ships will experience less spray but experience more wind. Icebreakers will roll heavily, while destroyers may suffer from more icing due to sea spray. All of these factors will result in special problems peculiar to each type of ship. It may be necessary on all ships where there is considerable icing and heavy seas for special watches to check that exposed bulkheads are actually watertight and not jammed with ice. These are but a few of the equipment problems met in arctic operations. (It is not the purpose of this report to review equipment failure, but rather, to allude to it only when it has application for personnel operations.) Many reports indicate that equipment should be redesigned to meet the special personnel problems created by arctic conditions. This area of "Human Engineering" has been discussed in the Research section.

6) Supply

a) Navigation problems

During summer months it may be expected that a good proportion of naval operations will take place. Landing supplies at isolated stations, exploration and scientific investigations, maneuvers, and training exercises, supporting amphibious operations, and many other activities will be carried out (140A).

Weather conditions during the summer -- in July, August, and September -- when the ice has broken sufficiently to allow ship's passage, tend to be changeable. Off-shore, sudden storms, ice, fog, rain and some snow will all tend to limit visibility. Since charts in many regions of polar waters tend to be unreliable or incomplete, navigation will demand great skill and reliance upon use of radar and the fathometer.

b) Landing supplies and troops

In landing supplies, speed and efficiency are probably of utmost importance. Round-the-clock operations are usually required. Working under these conditions it is reported that the work shift for personnel unloading supplies has varied from 12 hours (177A) to six hours (92A, 86A). Since work must be done in a hurry, there is a tendency to push the crews quite hard. In the Point Barrow Supply Expedition men working on six-hour shifts started to evidence signs of fatigue and decreased effectiveness after fourteen days. Careful consideration must be given to the optimal length of time that shift crews can work efficiently. Factors contributing to this will be the temperature, wind, and amount of experience which the unloading crews have at handling cargo. Docks and facilities for receiving supplies will, in most cases, be crude but adequate. At Point Barrow, for instance, supplies are landed by rafts and amphibious tracked vehicles at designated beaches. This type of operation requires careful planning and is best implemented through the use of trained cargo handlers and beachmasters overseeing the operations. Adequate weather information must be available at all times and landing operations may have to be postponed due to high surf and sudden storms (109A).

Drying stations should be set up on shore and in cold weather of +20°F or lower; care must be taken that personnel do not oversweat and then be required to stand around in the open. In such cases extreme discomfort will result.

In landing troops during amphibious operations, certain problems become apparent. Before debarking onto landing craft, troops must remain relatively inactive below decks clad in heavy arctic clothing. Overclad as they are in relatively warm quarters, a great many of the troops may perspire excessively. Once above decks and under conditions of relative cold, their clothes may freeze. Landing nets used to climb into small boats become icy and quite dangerous. While in the small boats, it is of course

important that means be devised to prevent troops from becoming wet. After troops have landed, problems are the same as those encountered by infantry troops. The best known example of amphibious troops being caught in low temperatures is that of the Marines in Korea. The problems then become those of enduring through long marches and surviving in trenches (interviews).

Boat crews kept on duty constantly on amphibious operations are reported as needing frequent relief when temperatures are below +20°F (136A). In all probability, as long as open supply rafts and boats of a similar nature are used, these problems will be present.

b. Land-based operations

1) Supply and transportation

The problems confronting personnel based ashore will vary to some extent with the severity of the cold, with the terrain, and with the location. Transportation in wet snow will create different problems than transportation of supplies over dry snow or in the summer. For instance, in one operation conducted in wet snow of 30-inch depth, it was not possible to travel more than one-half mile in an hour (93A). In the summer, bogs and muskegs will require tracked vehicles which will distribute their weight in such a manner as to be supported by the light layer of matting covering the muskeg. Swarms of mosquitoes and other insects may be expected to be present in the summer. Near the sea, ice fog will cause conditions of "arctic whiteouts," wherein the horizon is not distinguishable. Loss of direction, under these conditions, occurs frequently. In the winter, supply operations such as are carried out at Point Barrow require large trains of tracked vehicles pulling sleds. In severe cold, there may be extreme differences in the temperature of various layers of air within a building if proper methods of ventilation are not used. For personnel working indoors, such as typists, radio operators, etc., these variations in temperature may be a source of discomfort and loss of effectiveness.

The relative isolation of posts and the limitation in means of transportation requires that provisions must be made to store large quantities of equipment, food, and other necessities. Adequate allotment must be made for proper coordination between the base and its source of supplies. Airstrips must be constructed and maintained, and suitable beach facilities for landing supplies prepared.

2) Maintenance and communication

The problem of isolation requires that every unit be self-contained. Provisions for maintenance and repair of machinery must be available. Medical problems of a minor nature should be treated at the base. In essence, specialists of all types necessary to maintain a small community must be available. As was stated previously, the severe polar climate may be expected to cause many failures of machinery and equipment. Failures, to a great extent, appear to occur in the open, and quite often in the case of vehicles, etc., demand immediate repair.

At times, water supplies in the winter may be expected to be somewhat curtailed. Living stations may also be expected to vary considerably. In many places, latrines, mess facilities, recreational facilities, maintenance quarters, etc., may be far below standard.

Because of the problems of drifting snow, the physical layout of camps and bases may cover a large area. This distance between buildings will, under some conditions, cause problems of communication and restrict the rapid organization of personnel. In one operation (189), for instance, the distance between tents caused some confusion when attempts were made to muster personnel. At Fort Churchill, showers and latrines are separated from other buildings and it was a source of annoyance to personnel to constantly don and take off bulky arctic clothing when going from building to building. It would appear that storage buildings and work areas should be so planned as to minimize physical distances. Conventional layouts for camps should be discarded in favor of more functional ones (interviews). Illustrating this is the report (84A) from one weather station where the parking area for planes was placed near the fuel caches, allowing the planes to be refueled without the necessity of transporting gasoline drums.

3) Individual efficiency

As indicated in the previous section (cf. Navy Maintenance), the effects of extreme cold combined with cumbersome arctic clothing can curtail individual efficiency. These factors operating on personnel with inadequate previous training can have serious consequences. For instance, in Task Force Frost (130A) normal drivers of vehicles found themselves incapable of making first echelon repairs. As a result, battalion motor pools were swamped with work which would not have ordinarily been required of them. Delays in the winterization of vehicles were extended for quite some periods, and a great amount of mobility was lost during this operation. To overcome these factors of loss of dexterity some expeditions have tried directing sources

of warm air on to the hands of mechanics working in the open, and also upon the equipment which they are using.

One of the difficulties inherent in the equipment employed in polar regions is the fact that it has not been designed for use in extreme cold. Even though the material itself may not be affected, its use is. Tools such as nails should be preheated at times in order to facilitate handling. Heads of screws are at times too fine; screwdrivers, if not made of special steel, will, at times, crack in severe cold. Maintenance work on vehicles' engines must be performed under exposed conditions rather than allowing access to the motor through the heated cab. One operation reported on a "snowmobile," so constructed as to permit crews to make repairs from the inside (35A).

In spite of difficulties, it is possible to conduct an effective operation in the Arctic. For instance, on one operation (133), a Canadian experimental supply exercise using tracked vehicles in severe winter, personnel worked from six to eight hours a day driving and repairing their vehicles, plus approximately another three hours preparing camp, making food, and in general, bedding down for the night. While it is true that a good part of their working day was spent in the heated cabins of their vehicles, vehicle repairs and time spent preparing camp were accomplished in the open. Most reports indicate that individuals can work under conditions of cold (without high wind). In another operation (189) efficiency was reduced, not by the cold itself, but by the time spent in doing work necessary for personal survival. The burden of traveling through snow, loss of dexterity and agility due to cumbersome clothing, would all seem to contribute to the drop in effectiveness. But these effects seem not to be due to the effects of the cold, per se, but to the restrictions of the measures that personnel must use to protect themsleves against this cold.

All these military reports and civilian research cast serious doubt on any generalization about the effects of cold on a specific task. Such statements as, "an individual's efficiency drops 2% with each degree in temperature below 0°F," are certainly suspect and are doubted by many who point out that work can be done at 50° below zero. At present, one can only make general statements about the effects of the Arctic on job efficiency; information on individual efficiency in terms of the wind chill factor, although highly desirable, is not available. The work feasibility chart provided in Army manuals indicate the general type of transportation activity possible

during different months of the year, but they did not provide specific data on the charges in performance for particular jobs. The need for an effective temperature and wind chill scale for job performance will be discussed in the section on Research Recommendations.

c. Air operations

Problems peculiar to polar flying are not extensively reported in the literature.

It is assumed in many instances that most problems associated with flying in polar regions can also be found in most regions of the world where high altitude flying is done. The extent to which this statement can be accepted is not certain. Probably three factors may be considered specific to polar regions. The first relates to an increase in faulty radio communications between planes and their bases. "Fadeouts on medium and high frequencies due to ionospheric disturbances are more frequent and remain in effect for longer periods of time. High frequency propagation over long distances, even when normal conditions prevail, is at times, extremely erratic, and usual practices for selection of optimum working frequencies are not always valid. Other interferences come from the shielding effects of mountains, and in fiords or enclosed harbors communication may be lost completely." (109A)

The second relates to the usualness of poor weather, especially in the summer near water. Fogs are reported to occur 90 to 180 days a year. Flights may also be expected to encounter rain, sleet, and snow (140A).

The third factor relates to the problem of navigation. Horizontal components of the earth's magnetic field, the amount of magnetic variation, the rate of change of such variation, etc., are such that standard aircraft magnetic compasses are reported as useless (140A). Therefore, navigation is most often carried out by astro compass. However, many times star fixes are not possible due to fog and poor weather. Many times flights will be conducted when only the sun or moon can be used as celestial navigational aids (108A).

It has been found that often flyers are apprehensive about flying in cold weather, primarily because of fear of being forced down (174A). To some extent their fears may be justified. It is reported that chances for survival and rescue after air crashes (87) depend upon the base having a fairly close approximation of the planes last position. In the event of radio fadeouts, or inability to obtain a navigational fix due to weather conditions, plane crews will have their chances of rescue diminished accordingly.

Ski landings and takeoffs from snow and ice will be used quite often during the winter months. Certain skills must be acquired by the pilots in this type of operation. Due to the increased interest in the frozen Arctic seas as landing bases, additional skills in landing on this unprepared ice must also be acquired. One Air Force report (153A) fully discusses the problem encountered on this type of operation.

Aside from the above general material there appears to be very little of a systematic nature describing unique job requirements under arctic conditions.

D. MORALE

The problems of morale are not isolated from those discussed in the other sections of this report. Morale is interwoven with each of the other major factors involved in working and living under extreme cold conditions. Morale questions which occur are:

Are there any morale factors which are apparently unique to arctic life, or is it a matter of differences in the specific determinants?

What factors are mentioned in various reports as important for morale in the Arctic?

For various operations that have been reported relating to factors which influence morale (e.g., work conditions, recreational facilities, leadership, living conditions), which have been sources of satisfaction and which of dissatisfaction in arctic service?

What is reported on the relationship between leadership and morale in the Arctic?

Nature of the Data: The data reported upon in this section varies from casually made (or reported) observations to extensive attitude surveys. There are no correlations reported of any measures of morale with other measures, such as indices of individual job performance or of the effectiveness of group operations. Most of the information upon morale, in published reports on arctic operations, is based upon informal and unsystematic observations. There are usually no data presented beyond the anecdotal level to indicate the basis for the comments on morale level. (There is also no way of knowing the extent to which extraneous factors influenced the reporting, in print, of the state of morale.)

From the attitude surveys, this section will attempt to classify and summarize the factors which have been reported as making for satisfaction and for dissatisfaction in arctic military operations.

Uniqueness and Importance of Morale Factors in Arctic Areas: There seems to be no basis for assuming, from the evidence available, that there are any morale factors which are unique to the Arctic as such. The minimum psychological needs which must be satisfied (and which the Navy should attempt to meet) are apparently the same as in other areas and situations. However, maintaining good morale is considered to be even more important in the Arctic than elsewhere by those experienced in various operations. The isolation and the threat, or reality, of severe weather conditions create conditions and stresses which affect morale. Direct contact, or at times, even communication with those not a part of the immediate group is generally not possible. The same people see each other continually over a long period of time; their small habits and foibles can, and frequently do become major irritants to one another (interviews). The opportunity for change and for variety of any sort is severely limited. A variety of recreational facilities are not generally accessible.

While polar conditions impose these stresses, so do many other military operations. Assignment to land duty in isolated areas, or in the Navy, assignment to submarine duty, will create similar problems. The importance of morale questions and the fact that they must be planned for and dealt with does not mean that these questions are unique to the Arctic.

Morale on Arctic Expeditions: The comparatively small number of men on an expedition being conducted to explore a new area or to obtain scientific data are usually highly motivated. This may be in contrast with the motivation typically found on a military operation.

On the land-based expeditions which were at one time the only major type of arctic operation, the men generally identified closely with the goals of the expedition and interest in the Arctic and the details of its geography, climate, and geology were quite high. Today, this feeling that the goal of the operation is also the goal of the individual may be missing. Much has been learned from the earlier expeditions, as well as from technological advances, which has been of value in providing men on military operations with better facilities for work, self-maintenance, and recreation than once existed. Despite this improvement in knowledge and facilities the feeling of personal participation has not been acquired to the same extent by men on arctic military operations.

While this is not surprising, it may create problems under conditions of stress. (These differences in identification with operation goals naturally relate to job performance, indoctrination, and selection questions, as well as to morale.)

Inter-Relationship of Morale Factors: In various reports referred to below, varying orders of importance for morale factors are given. One study may rank recreational facilities as most important, whereas another will consider living conditions important. It is apparent that these variations in emphasis are, in part, a function of the particular operation and the facilities available. If for example, living conditions are considered to be very good by the personnel reporting, then any need for recreational facilities will be more noticeable as an influence toward low morale.

1. Specific Morale Factors

a. Shipboard operations

1) Recreation

In some Navy operational reports, recreational facilities are most often considered to be highly related to high or low morale on shipboard (136A, 86A, 166A, 123A). In operational reports mention is made of the following (with decreasing frequency): motion pictures, games, ship's paper, musical shows, card playing, sports, reading, hobby shop, certificate for operations (171A, 178A, 188, 136A). Library, radio and phonograph, canteen, softball tournament, soda fountain, birthday cakes, community sing, comic strips, recreation room, recreation parties ashore, and fishing are also each mentioned once. Most frequently, these kinds of things are mentioned as most closely associated with high morale, with motion pictures (not old, second-rate ones) usually considered the most effective of these recreational devices.

The tendency in various reports is to assume that, if certain recreational facilities exist and if morale is considered to have been high, then the recreation must be the cause of the high morale. In general, the morale is thought by some of those reporting in the literature to be directly related to the number of these recreational devices which are available. However, there have been no studies in the Navy to show how important these recreational facilities are to morale when the effects of such factors as living conditions, personnel policies, or leadership are kept constant. The same ideas concerning recreation are expressed for non-arctic operations.

2) Factors other than recreational facilities

Generally, good personnel policies and good working and living conditions do the most to keep morale high in cold climates. Recreational facilities are of importance in relieving boredom, but

secondary to the other conditions, closer to the work situation. Factors which are mentioned as being responsible for good morale are novel surroundings (176A, 166A, 178A), leave policy (178A, 166A), attention to careers and advancement (166A, 134A), hours of work (166A, 174A, 172A), absence of rolling of ship (172A, 86A), living conditions (172A), and personnel "swaps" (172A). Of these, hours and conditions of work, and leave policy are reported as of greatest importance.

Organizing realistic work shifts, clarifying leave policy, and determining promotion policy are functions which can be carried out administratively. A great deal depends on making these policies clear to personnel before going into the Arctic and carrying out such policies during stays in cold climates.

Long hours on watch or doing maintenance are, of course, detrimental to morale. Leave policy must be definite, with personnel adequately informed as to when leaves are due. Along with this goes the need for making clear the opportunities for advancement. Special techniques, such as personnel swaps between ships, have been found to be advantageous in keeping morale high. Granting leaves on return from the Arctic has also been done (178A).

Living conditions include such items as crowded living quarters, ventilation, space for drying clothes, heating, lighting, interior painting, and comfort of mess decks (188, 174A). These conditions are felt to be of much greater importance in cold climates where living itself requires more time. The importance of food (168A) and mail (169A, 166A, 177A, 178A) have been emphasized with relation to morale in any area. (The problem of getting warm food is much greater on land where the individual must often prepare his own food.) The novelty of new surroundings is probably overemphasized if it is conceived as having a permanent effect on morale. There is a great deal of evidence that a long stay in cold climates lowers morale (187, 138A). On many of the naval operations in cold weather, a week or less was spent in all.

b. Land operations

For land operations, recreational facilities are not emphasized as much as in Navy reports. While these facilities are important, other factors, work conditions, living conditions, leadership, and personnel policies, seem to play a relatively greater role. This may be in part a function of the fact that the ship is more of a self-contained living and working

unit, with arctic problems less unique than on land. Isolation is reported to have a profound effect on morale. This possible isolation, while not unique to arctic operations, may be intensified by the extreme cold conditions (187). There is general agreement that men frequently show major personality changes during extended stays in the Arctic. These changes are described in various ways. After two to four months, there is "increased frustration, irritability and restlessness, decreased drive, and decreased ambition" (184A). From one of several attitude surveys there is evidence for a shift toward depression, insomnia, and lack of motivation. This change in adjustment is found to be more closely correlated with the degree of cold than length of stay. Scores on the Guilford-Martin Personality Test were better in the spring (April) than in the dead of winter (December) (78). For land-based troops, sources of irritation and low morale are reported in a group of attitude surveys. Typical of these studies is the one made at Fort Churchill with 78 enlisted men. Sources of dissatisfaction, to varying extents, were: work, housing, meals, and recreation (184A).

Most men felt that the officers were not interested in them. Many men felt that they themselves were more restless, irritable, apprehensive, moody, and less cheerful, and that sex was a problem, and felt more disgusted with things in general. Many also felt that they were more sociable and more independent.

Another questionnaire, given under similar circumstances, asked, "Under what conditions would you be willing to stay in the Arctic?" The men wanted the following: increased pay and prestige, better social life and recreation, better living conditions, and better working conditions. It should be noted that there were no groups (non-arctic) against which the answers of these men could be compared. It might be that responses of men in cold climates would not differ greatly from those of other military personnel.

In another morale study, infantrymen and airmen emphasized rotation, leadership and behavior of officers and non-coms, ratings and promotions, inefficiency and waste in organization. Need for recreation was fifth as an area of dissatisfaction (97A). It is likely that recreational facilities are important, but that other work factors, leaves, and promotions are of even greater importance. Many men like cold climates. When an infantry group was transferred from Fort Knox to Fort Churchill, there was reported to be a raise in morale (interviews). Several reasons were given for this: novelty of the experience, the goal of studying in the Arctic was more apparent, footgear and packs were more comfortable, the end of the program was in sight, and Fort Churchill was a true bivouac. Some of these observations occurred because the persons at

Fort Knox were uncomfortable taking cold weather training in a temperate climate. It does show that troops can learn to accept arctic conditions with correct training and procedures.

The general consensus is that more of all forms of recreation are needed (175, 122, 109A). Motion pictures are thought to be very important; there is increased emphasis on "service clubs," and a need for hunting and fishing. There is a definite need for the men to have something to do. However, it must not be thought that making recreational facilities available will automatically insure that persons will utilize them. In one morale study, over three-fourths of the personnel did not engage in such sports as hunting and fishing (73). Living conditions are important on land, but may be less important than working conditions. Improvement in morale has been attributed to improvements in lighting (93A), and good morale to redistribution of tasks (189), and bad morale to over-exertion (83A). These fragments of information indicate that there are important factors in work and living which have not been adequately explored. A possible relationship of these factors to leadership is indicated below.

The kinds of complaints of men differ according to climatic conditions. It has been found that complaints of men on health problems are different in the Aleutians and the mainland of Alaska. Men in the Aleutians have more complaints about respiratory difficulties, and those on the mainland have more complaints about muscle aches and heart pains. This shows rather clearly that problems in morale and varying kinds of complaints may result from general dissatisfaction with military service. Actually, the Aleutians have been found to be one of the most healthy climates in most respects.

c. Leadership

Most of the information relevant to leadership problems in cold climates is relevant to ground troops rather than naval operations. Expeditions for scientific or exploration purposes have had different leadership problems than naval operations, since there were differences in the personnel motivation of those on the operation.

There is evidence in the literature on leadership in the arctic regions that psychological adjustment in this region is not governed by the severity of the cold itself, but relates to the success or failure of leadership provided by officers in dispelling effects of isolation which the cold produces (183). When there is good leadership at a base, even very poor living conditions appear to have no serious effect on the morale of the men. One study (157A) was made at a base in which there were very

good living conditions; however, the leadership was poor and the morale was low. This base was compared with another one which had very poor living conditions but good leadership, and the morale was high.

Evidences of poor leadership have been noted in various bases, and it has been contended that it has been poor largely because of unqualified men (187). In one report concerning how soldiers thought officers "measure up," there were no laudatory comments. This is probably striking in that no enlisted man was motivated by admiration for his good officers to the same degree that other men were motivated by their dissatisfaction (122).

As pointed out in the literature, good leadership of small units is essential (180A). Men have to work together in small teams, such as in supply tractor trains requiring highly technical personnel (self-maintaining units) (182A). It is necessary that the men work well in these small groups and this is largely the role of good leadership (187). The importance of good leadership is continually emphasized in reports and interviews.

The uniqueness, to the Arctic, of leadership techniques or characteristics is questionable, even if leadership importance is not. In ship operations, differences between and among Coast Guard and Navy operated ships and icebreakers has been reported (interviews). The use of a more flexible leadership approach than is sometimes used has been said to have favorable effects on morale.(interviews). Such non-regulation devices as playing records over the ship's P.A. system were used. The contrary approach of maintaining standard procedures and policies has been stated to be effective since the men will be able to consider arctic operations a routine process which need not disrupt them unduly (interviews).

What are the important characteristics of good leaders in the Arctic? Many of the references to leadership, as mentioned in the Selection Section, give rather general descriptions, "ingenuity and the ability to meet new problems, high physical ability and endurance" (93A), and "knowledge and ingenuity" (192). And of the "good arctic man," he "enjoys adventure, opportunity for ingenuity, below-average drive, cheerful, good with small groups, high intelligence, well-integrated personality, and motivated." This kind of anecdotal information is of little value because it does not indicate specific areas of performance in which leaders must excel.

Other arctic leadership qualifications mentioned have been previous satisfactory command for a period of one year, in which the officer has demonstrated emotional stability (133). Complete training in environmental protection is needed (192). He should set the example for his men by wearing correct clothing and following rules to encourage his men in carrying out satisfactory habits (192). An officer in the Arctic should be cognizant of his men's interests, and should try to find jobs for them which fit these interests and the men's abilities. He should know how to delegate authority and responsibility (133). In the Selection Section of this report there is further discussion of leadership characteristics.

E. GENERAL PHYSICAL AND PSYCHOLOGICAL REACTIONS TO EXTREME COLD

This last chapter is concerned with the generalized effects of and adjustments to extreme cold. The problems may appear at first to be only remotely concerned with practical naval requirements. However, it is only from an accurate knowledge of the basic facts, of which many are incompletely understood, that the total picture of how a man reacts to cold can be developed. The other sections of this report are oriented more directly toward specific problems of naval operations in arctic environments.

No generalizations can be made without qualification concerning bodily reactions to cold. The variety of conditions under which personnel live and work all contribute to different bodily reactions. Some men, for instance, will spend most of their working day protected from the elements. Others will be protected except for short intermittent exposure, and still others will spend most of their time outdoors. The living conditions also will affect bodily reactions. Living in the field in a tent is quite different from living in barracks, and again different from living on a ship. It is therefore difficult to outline the physiological reactions to cold common to all these different modes of living.

This section will, therefore, indicate the physical effects of extreme cold under many rather than all conditions.

1. Health

In extreme cold (near 50°F) reports indicate that there is some tendency for personnel to develop coughs; in many cases some spitting of blood can be expected due to congestion of the mucous membranes (189). Aboard ships and in well-insulated and heated barracks the resulting dryness of the air may also cause dry throats and even bloody noses (177A). However, these symptoms are not severe and do not appear to leave any permanent effects.

Chapped lips, lesion of the lips, and other minor irritations may be expected to appear on personnel working aboard ships under conditions of wet-cold. Applications of camphor ice and other such unguents appear to alleviate this problem. Some personnel will experience minor abrasions about the hands and wrists due to the resulting clumsiness of handling and using tools under severe weather conditions.

Some dental problems of a severe nature may be experienced by personnel constantly exposed to extreme cold (-20°F to -50°F). On one operation there were reports of metal alloy fillings contracting and pulling away from cavities (189). The resulting open cavity is extremely sensitive to the cold. On recent naval operations care has been taken to thoroughly check the condition of teeth of all personnel prior to departure.

Frostbite is the most serious health problem in the Arctic. The extremities, toes, hands, and the face appear most sensitive to attack. Either excessive cold or a biting wind will result in frostbite if sufficient preventive measures are not taken. Reports indicate that, except for a very minimal sensation, personnel will not be aware of becoming frostbitten. Thus, recommendations for guarding against frostbite, in addition to those concerned with proper clothing, will also include proper utilization of the "buddy" system. In this procedure, individuals watch each other for the characteristic blanching of the skin which denotes the beginnings of frostbite. It is encouraging that on recent operations in polar regions the numbers of severe cases of frostbite was kept to a minimum. That is due primarily to two factors: first, more effective utilization of the "buddy" system, and second, better training methods so that the individual learns to react to minimal cues and can initiate appropriate preventive measures before actually becoming frostbitten.

2. Adaptation

The processes by which an individual develops the ability to function more effectively in polar climates has been termed adaptation or "accustomization." In broad terms, this refers to the adjustment of the individual on all levels -- physically, physiologically, and psychologically. The individual ceases to view the climate as hostile and one against which he must constantly protect himself. Instead, there is a reorganization, both on a bodily level and on a psychological level which permits adjustment to and acceptance of these new conditions. The results of this accustomization are reflected in work output -- wherein the individual can function without depending to such a great extent upon protective measures which interfere with his effectiveness. Psychologically, this accustomization may be reflected in a reorganization of an individual's standards, needs, and drives so that he may

better withstand the isolation, loneliness, restrictions upon mobility, and lack of usual recreational facilities. The unacceptable now becomes, if not acceptable, at least tolerable.

In order to organize the findings related to this area, accustomization will be discussed under three headings: (1) physical accustomization, (2) effect of adaptation on job performance, and (3) adaptation of personality.

a. Physical accustomization

The study of physical accustomization is very difficult. As yet, there has been no conclusive evidence produced that bodily changes associated with acclimatization do occur (34). However, enough suggestive evidence is available to assume that some degree of physiological acclimatization does take place.

In the process of acclimatization it is assumed that certain modifications occur in the body to reduce heat loss in cold climates. However, findings from laboratory experiments usually fail to uncover any important bodily changes. In some cases, individual differences (for the small number of cases studied) contribute to the lack of significant results. In other cases it would appear that the experimental designs used are not adequate.

However, various field experiments and studies on populations indigenous to cold climates report many important bodily reactions to cold which differ from the bodily reactions of the individual newly introduced to cold climate (34). These bodily reactions are mostly in the direction of allowing better adjustment to the severe environment. While laboratory results are not very promising, the field reports seem to indicate that the laboratory researches may be inadequate, perhaps because of poor experimental design. Among the more interesting findings* are reports that:

* This report is not concerned with presenting many of the physiological changes such as changes in cholorides, protein, red cell content, etc., reported by various authors as being related to acclimatization. Rather, it is concerned with the gross changes that may directly be related to field behavior and functioning.

Individuals who worked under conditions which were more exposed to cold were less susceptible to facial frostbite than individuals who worked under protected conditions when both groups were later exposed to the same cold weather conditions (63).

In experiments involving the immersion of the feet in ice water, those individuals who had worked longer with unprotected hands in cold weather, had less vaso-constriction of the hands and a lower incidence of frostbite than those who had not worked with unprotected hands (4).

The average basal metabolism rates of Eskimos have been reported as 25% or 30% above the norm for whites who abide in the temperate zones (14). However, this high rate may possibly be attributed solely to their diet rather than processes of acclimatization.

Eskimos and Australian aborigines are reported as exhibiting less vaso-constriction of the extremities upon being subjected to severe cold than natives of warmer climates (4).

Experiments with rats also indicate an increased basal metabolism rate after exposure to cold. Another study reported significant differences in survival rate between two groups of rats after exposure to extreme cold. Both groups were equated and were subjected to two different environments: one lived in a moderately cold chamber, while the other was exposed only to a temperate climate. After exposure to extreme cold, the group with moderately cold experience had a much higher survival rate (interviews).

The findings are in accord with certain current theories of the regulation of body heat. Carlson and others (101) advance the view that acclimatization depends mostly upon the maintenance of a small body heat core so that under conditions of extreme cold the individual has a smaller portion of his body to maintain at a constant maximum temperature. This theory seems to explain many of the reported field findings. That is, with the individual requiring a smaller core of constant heat needed especially for the internal organs, he can, during periods of relative inactivity, store up more body heat and thus have more heat available for periods of extreme cold. Circulation in the hands and feet appear to be mainly dependent upon the general body heat balance; when there is less demand on this heat balance, increased circulation to the extremities and less vaso-constriction will result. Thus, such findings as lower incidence of facial frostbite, less peripheral vaso-constriction, greater tolerance to severe cold, all appear to be related to the increased peripheral circulation and to the concomitantly increased heat

released to the periphery. Carlson also points out that the decreased core of body heat needed by the acclimatized individual should result in less caloric intake, and the acclimatized man should theoretically have a lower metabolic rate that the non-acclimatized. However, this is not necessarily true, since it is possible that the acclimatized man could have just as high, or higher, a metabolic rate, but use this increased heat more efficiently than the non-acclimatized man.

b. The effects of adaptation on job performance

The increase in general effectiveness with which the acclimatized individual can perform his duties, relative to the non-acclimatized man, will not be tremendously large. Rather, it is expected that there will be a general facility for dealing with his environment not found in the non-acclimatized individual. Physical dexterity should increase. General sensations of cold and discomfort should not be as great, and the need for frequent pauses and relief relatively reduced. In general, there should be a greater acceptance of the environment.

Bodily adaptation is only one factor related to the greater facility shown by the acclimatized individual. Reference must be made to the general "accustomization" to his environment developed by the individual.

One source points out that at the beginning of the winter the men were quite disturbed by the severe winter and overdressed and encumbered themselves for protection (24). After three months of -40°F temperature, the mercury rose to about freezing and the men felt quite comfortable in their shirtsleeves. One may assume that this growth of tolerance for the new environment also developed an increased facility for performing effectively. Less time being devoted to clothing, to keeping warm, and more time effectively devoted to actual job performance.

A very interesting experiment (174A) was reported relevant to the problems of those personnel who will be required to work for only short periods of time under exposed conditions. Loss of manual dexterity seems to be primarily related to a diminishing of blood supply to the hands due to the body's need to preserve heat. In this study, the body's heat supply was increased artificially through warm air "piped" indirectly to the clothes. Under these conditions, little or no vaso-constriction of the peripheral vascular system took place. The hands, even though unprotected and subjected to extreme cold, remained fairly comfortable and the men were able to maintain a high degree of dexterity. For duplicating some of the more positive results of physical adaptation, these results appear quite important.

In all probability there will be marked differences in individual rates of adaptation and cold tolerance (4). Under these circumstances, some sources indicate that commanders should not issue strict orders regulating what troops should wear (interviews). Adherence to strict orders as to clothes may result in some individuals being overdressed and some men being underdressed in terms of their own rates of adaptation.

c. The effects of adaptation on personality

It may be expected that some naval land installations will be located in relatively isolated areas. The problems of personal adjustment at these bases will be discussed briefly.

Polar territories include a great variety of physical conditions. However, severity of winter climate, relative isolation, and poor transportation are characteristic. Persons who will live and work under these conditions will have to make certain personal adjustments in order to cope with these factors. He can no longer follow the usual recreational and social patterns that may have been pursued in the States. Severe weather may frequently restrict personnel to the barracks. A decision to go out from one building to another may entail the lengthy and annoying procedure of donning bulky clothing. Visits to local cities are, in many instances, not possible and the facilities available are usually undesirable. Recreation is limited largely to movies, cards, reading, and social communication among military personnel. While the arctic territories make possible a wide variety of outdoor sports (in a survey of airmen stationed in Alaska), almost three-fourths reported that they did not participate in these activities (74).

Under many conditions, it would appear that little or no change occurs in the personalities of personnel living in the Arctic. Thus, reports of shipboard operations indicate little or no change in the reactions of seamen. However, since most of the operational reports which were read concerned summer operations of relatively short duration, this finding cannot be generalized to prolonged expeditions, especially those held during the winter. For most personnel, such short visits to the Arctic were an adventure. A study of airmen stationed at Ladd Airfield, Alaska, for 18 months also indicated no pronounced personality changes (79). The men studied in this investigation were well-housed, with a wide variety of recreational facilities, and could visit small cities on weekends.

On the other hand, a survey of Russian literature reported that individuals experienced a wide variety of personality changes after being in the Arctic for awhile. Many individuals became moody, cynical, and at times, euphoric. Their findings indicated that the ordinary individual (not the highly motivated, such as explorers or scientists) was influenced by the severity of the climate, monotony, polar nights, the isolation and finally, the restrictions of their freedom of movement (165).

Some American findings at Fort Churchill agree essentially with the Russian findings. Individuals studied at Churchill were reported to show decreased drive toward activity, inflexibility of behavior, increased sociability and cheerfulness, indifference, and relaxation of inhibitions. Initial contact with the Arctic produced frustration, irritability, and increased general activity which changed to eventual passivity (184A). The authors of the study offer the hypothesis that personality changes under arctic conditions tend to move in the direction of those that are needed for apparently satisfactory adjustment, and tend to be established five to six months after arrival in the Arctic. Conditions at Churchill varied from those reported at Ladd Field to the extent that recreational facilities were much more limited at Churchill at that time, the men were not assigned to their correct job classifications, mobility was restricted to a greater extent than at Ladd Field, and housing conditions were not as satisfactory.

A series of attitude studies conducted among troops stationed in Alaska indicate some of the problems to which individuals are required to adjust. In one study, loneliness, increased alcoholic consumption, and increasing sex problems were indicated (73). In another study of a group with low morale, personality tests indicated depression and general dissatisfaction with routine (78). In a third study of a group with low morale, the men appeared to be more depressed, neurotic, and their test scores on personality inventories resembled an Army AWOL group (77).

While the Churchill studies indicated that the length of stay in the Arctic was related to personality adjustment, a Ladd Air Force study indicated the reverse of this finding for some groups. Airmen assigned to the Arctic on temporary duty all indicated fairly negative attitudes about this assignment before their arrival (72). While on temporary duty, a follow-up survey indicated no changes in these negative attitudes. Thus, one may infer that at least one of the factors related to personal adjustment to the Arctic is concerned with preconceived attitudes which the individual brings with him upon going to the Arctic.

The conflicting evidence on the problem of adaptation of personality will be discussed in the Research Recommendations Section of this report.

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APPENDIX A

LIST OF PEOPLE INTERVIEWED

INDIVIDUALS INTERVIEWED

Those interviewed in the United States included the following:

Col. Bernt Balchen,
Special Assistant to the
Director of Air Installations,
U. S. Air Force

Mr. R. B. Black,
Operations Research Office,
Johns Hopkins University

Lt. Col. W. T. Bray,
USMC

Lt. Col. N. D. Brown,
U. S. Engineer Corps.,
U. S. Army

Col. A. Carstens,
(Arctic Aeromedical Laboratory)
Ladd Field, Alaska, U. S. Air Force

Capt. J. E. Cohn,
Assistant Director, Research and
Development Division, Navy Bureau
of Ordnance, U. S. Navy

Major A. Debons,
U. S. Air Force
(Assigned to Columbia University)

Mr. Glen Dyer,
Arctic Operations Project,
U. S. Weather Bureau

Mr. R. C. Faylor,
Environmental Research Section,
Research and Development Division,
Office of Assistant Chief of Staff,
G-4 Logistics, U. S. Army

Mr. V. Fields,
Assistant Head, Classification and
Survey Research Branch, Research
Division, Chief of Naval Personnel,
Bureau of Naval Personnel, U. S. Navy

Lt. C. O. Fiske,
Military Sea Transport for Service,
U. S. Navy

Dr. S. R. Galer,
Office of Arctic Encylopedia

Dr. Richard Gaylord,
Personnel Research Section,
Personnel Research and Procedures
Branch, Office of the Adjutant
General, U. S. Army

Cdr. J. E. Gibson,
Cold Weather Readiness Section,
Operational Readiness Division,
Office of the Chief of Naval
Operations, U. S. Navy

Mr. E. C. Goodale,
Arctic Operations Project,
U. S. Weather Bureau

Cdr. M. K. Holler,
Arctic and Cold Weather Medicine
Section, Bureau of Medicine and
Surgery, U. S. Navy

Lt. Col. A. N. Jackman,
Environmental Protection Branch,
Research and Development Division,
Office of the Quartermaster General,
U. S. Army

Mr. W. Johnson
Bureau of Yards and Docks, U. S. Navy

Col. F. J. Knoblauch,
Deputy Chairman, Medical Research
and Development Board, Office of
the Surgeon General, U. S. Army

Dr. Liebman,
Arctic Institute of North America

Col. J. B. Loftus,
Research and Development Branch,
Office of the Quartermaster General,
U. S. Army

Col. A. C. McKinley,
Office of the Chief of Naval Operations
for Polar Projects, U. S. Navy

Mr. J. Patsky,
Research Division, Chief of Naval
Personnel, Bureau of Naval Personnel,
U. S. Navy

Dr. L. C. Peltier,
Protection Branch, Quartermaster Corps,
U. S. Army

Dr. L. Petrullo,
Human Resources Research Laboratory,
U. S. Air Force

Dr. L. Quam,
Geography Section, Earth Sciences
Division, Assistant Chief for Research,
Office of Naval Research, Executive
Office of the Secretary, U. S. Navy

Cdr. P. W. Roberts,
Director, Planning Division,
Bureau of Yards and Docks, U. S. Navy

Cdr. Finn Ronns,
Consultant to Office of the
Quartermaster General, U. S. Army

Cdr. J. R. Schwartz,
Cold Weather Readiness Section
Operational Readiness Division, Office of
the Chief of Naval Operations, U. S. Navy

Dr. P. A. Siple,
Environmental Research Section,
Research and Development Division,
Office of Assistant Chief of Staff,
G-4 Logistics, U. S. Army

Mr. J. Slauta,
Research and Development Branch,
Office of the Quartermaster General,
U. S. Army

Col. R. R. Stewart,
U. S. Air Force (Assigned to North
Atlantic Treaty Organization Standing
Group, Department of Defense)

Col. Robert Sykes,
Arctic Operations Project, U. S.
Weather Bureau

Mr. L. Wexler,
Environmental Section, Research
Division, Bureau of Yards and Docks,
U. S. Navy

Major M. A. Wiener,
Office of Director of Requirements,
Deputy Chief of Staff, Development,
U. S. Air Force

Major H. G. Wise,
Aviation Medicine Branch, Human
Factors Division, Director of
Research and Development, Deputy
Chief of Staff, Development, U. S.
Air Force

Sir Hubert Wilkins,
Consultant to Office of Quartermaster
General, U. S. Army

Col. Walter Wood,
Arctic Institute of America
(New York Office)

Mr. Wood,
Arctic Operations Project, U. S.
Weather Bureau

Mr. Wright
Canadian Embassy, Defense Research Bd.

Lt. Col. F. A. Zehrer,
Clinical Psychology Branch,
Psychiatry and Neurology Consultants
Division, Office of the Chief of
Professional Division, Office of the
Surgeon General, U. S. Army

INDIVIDUALS INTERVIEWED

Those interviewed in Canada included the following:

Mr. J. Cantle,
Chief of Arctic Services,
Canadian Resources and
Development Board

Dr. T. Cook,
Chief Psychologist,
Human Resources Section,
Canadian Defense Research Board

Maj. D. Green,
Training Section
Arctic Warfare Division,
Canadian Army

Mr. Trevor Howard,
Arctic Section,
Canadian Defense Research Board,
Snow, Ice and Permafrost Branch

Mr. Henry Larson,
Inspector in Charge of Yukon
Territories,
Canadian Royal Mounted Police

Col. Graham Rowley,
Head of Arctic Section,
Canadian Defense Research Board

Mr. Hattersby Smith,
Glaciologist of Arctic Research
Section,
Canadian Defense Research Board

Mr. Frank Spaulding,
Inspector,
Senior Personnel Office,
Royal Canadian Mounted Police

Mr. A. Stevenson,
Assistant to Chief of Arctic
Services,
Canadian Resources and
Development Board

APPENDIX B

INTERVIEW FORM

INTERVIEW

INTRODUCTION: Parts to be covered:

1. Interviewer: name, office, ONR, clearance.

2. Type of data obtained up to now: literature, what RBH has done so far on the problem.

3. Type of answer RBH hopes to provide in its report: not final, but best estimate of present status, information, leads (not try to solve all problems).

4. Type of interview: series of questions emerging from literature.

PERSONAL DATA

1. Could you tell me something about your job? Where it was located, what the weather conditions were, how long you were there, what you had to do?

SELECTION

2. Can the usual ship's complement operate effectively in arctic areas, or is special selection needed?

3. What are the characteristics of individuals who "crack up" in the Arctic (and might not "crack up" elsewhere)?

4. Are there any (other) special disqualifying characteristics? What are the characteristics of men who "accept" the Arctic with a minimum of training? Can these men be selected for arctic duty?

5. Are specialists in arctic performance needed?

6. Do people from the North adjust better?

7. Can people from the South adjust?

JOB FACTORS

8. A statement that we have heard is: "An individual's efficiency drops 2% with each degree of drop in temperature below 0° F." Do you know of any (actual) data that supports or denies this?

9. Are there any particular types of jobs or billets which are most affected by polar conditions or most in need of revision? How about Navy watches? What schedules do you suggest?

10. Should Navy personnel be able (required) to do more than one job if they are to serve in arctic operations?

11. Should the buddy system be used on Navy watches?

12. Are more men needed to do a job in the Arctic? Can this be reconciled with space problems on ships?

13. Should standards of acceptable performance be higher in the Arctic (because of the importance of good work) or lower (because of the difficulties of doing a good job)?

TRAINING

14. Is arctic experience more important than knowledge of the job? How much special training is needed, on the average, to produce acceptable work performance in the Arctic? Will this vary with the type of job?

15. Should ship's crews get special training in a special school?

16. Knowing and working under cold conditions helps for arctic adjustment, according to the present evidence. Do you think that training in the cold is warranted — in time and expense — for Navy operations?

17. Is orientation for ship's personnel, without "cold condition" training, sufficient for: a) self-maintenance, b) use of equipment?

ADJUSTMENT AND MORALE

18. How do men change after being in the Arctic for a while, if they do? How soon do these changes occur? What sort of changes are there?

19. Does mental alertness go down in extreme cold?

20. Are there morale problems due to the cold, per se, or are the problems those of any isolated area?

21. After living in the Arctic for a while, how well did your men get along with each other?

LEADERSHIP

22. Are there any leadership characteristics or techniques that are necessary in the Arctic but not elsewhere (and conversely, necessary elsewhere)?

23. Does the leader have to be out with his men during work?

24. Do officers require any special arctic training not given to the men or vice versa?

RESEARCH PROBLEMS

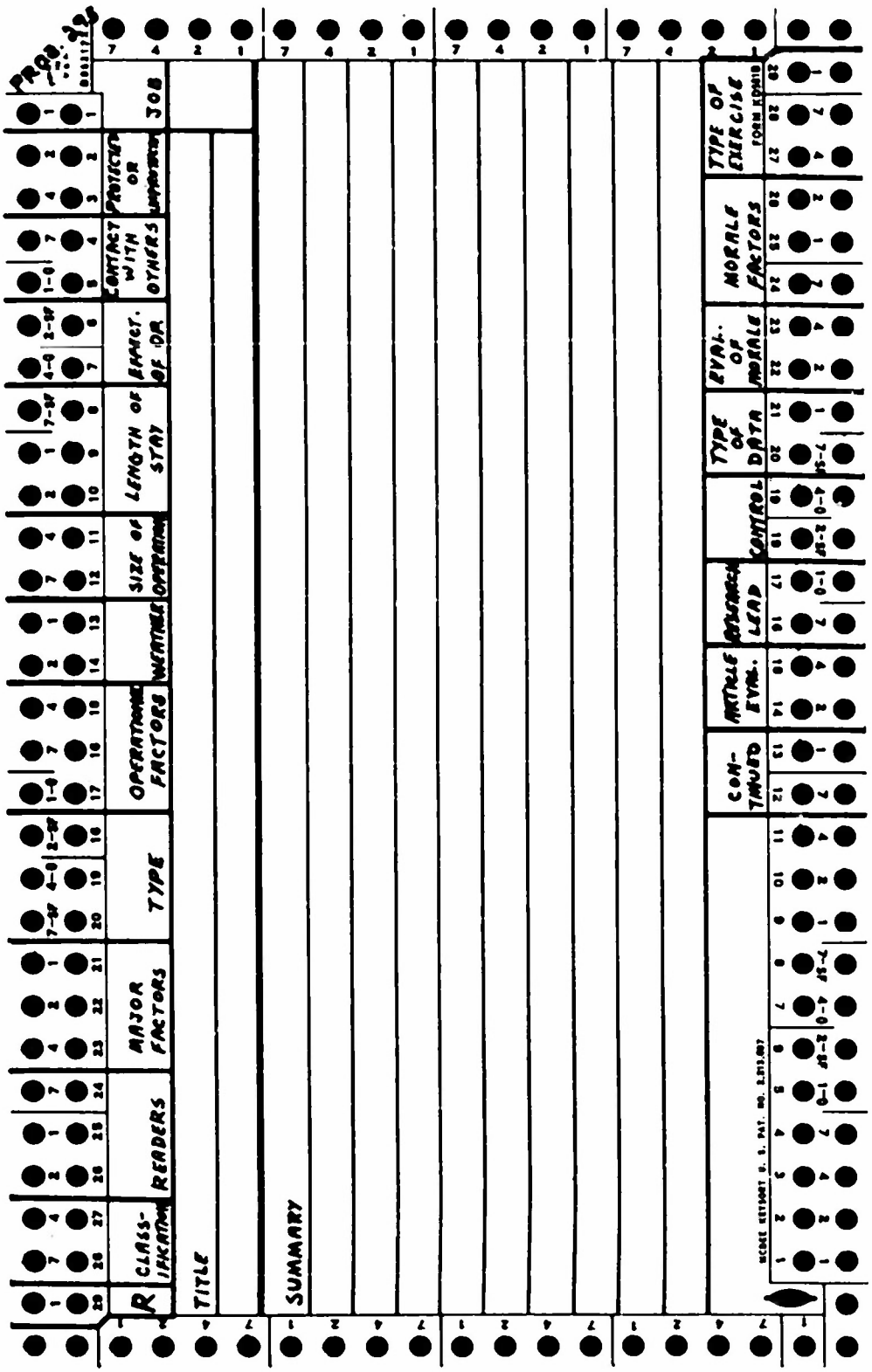
25. What do you think are controversial problems relating to personnel on which more information is needed?

26. What other information, in connection with arctic personnel questions, do you think we need (most)?

APPENDIX C

MCBEE KEYSORT CARD

Sample of McBee Keysort Card



APPENDIX D

CODING SHEET

PROJECT 295: CODE SHEET

Code titles read from left to right on top of card and from right to left on bottom. 0 = No Punch. Code numbers always read from left of line in following order: 1, 2, 4, 7 (disregard printed numbers).

A. Rank: 1 = Officer, 0 = EM or Unspecified

I. References

Classification: 0 = Clear, 1 = Restricted, 2 = Confidential, 3 = Secret
Readers: 1 = Kipnis, 2 = Zalkind, 3 = Feinberg, 4 = Thomson, 5 = Other

II. Major Factors: 1 = Polar Demand, 2 = Selection Factors, 3 = Training Factors, 4 = Job Factors, 5 = Adaptation, 6 = Organizational Factors.

III. Type: 1 = Physical, 2 = Abilities, 3 = Personality, 4 = Group, 5 = Other.

IV. Operational Factors: 1 = Sea, 2 = Land, 3 = Amphibious, 4 = Air, 5 = General.
Weather Conditions: 1 = Cold Wet, 2 = Cold Dry, 3 = Other.
Size of Operation: 1 = N less than 100, 2 = N 100-500, 3 = over 500.
Length of Stay: 1 = Under 1 mo., 2 = 1-3 mos., 3 = 3-6 mos., 4 = over 6 mos.
Effectiveness of Operation: 1 = Ineffective, 2 = Average, 3 = Smooth.
Contact With Others: 1 = Low, 2 = Medium, 3 = High.
Type of Duty: 1 = Protected from weather, 2 = Unprotected, 3 = Other
Job Type: 1 = Punch if special job type.
Type of Exercise: 1 = Laboratory, 2 = Scientific Exploration, 3 = Military Operation, 4 = Attitude Survey, 5 = Field Study, 6 = Other.

V. Morale Factors: 1 = Leadership, 2 = Personal Motivation, 3 = Physical Facilities, 4 = Group Interaction, 5 = Other.
Evaluation of Morale: 1 = Low, 2 = Medium, 3 = High.

VI. Type of Data: 1 = Quantitative, 2 = Systematic, 3 = Anecdotal.
Control of Data: 1 = Adequate, 2 = Inadequate.
Research Lead: 1 = Strong Lead, 2 = Fair Lead.
Article Evaluation: 1 = Outstanding, 2 = Adequate.
Continued on other card = 1, Continued from other card = 2.

VII. Reference

APPENDIX E

LETTER OF INQUIRY

RESTRICTED

SECURITY INFORMATION

RE: Contract No. Nonr-871(00)

We have been engaged by the Office of Naval Research to conduct a research project investigating personnel problems specific to polar operations. Essentially, the project calls for a critical review of available, pertinent literature related to problems in this area.

The chief desired end products, as stated in our contract, are....."Recommendations concerning personnel operations under polar conditions, based upon the collation of present-day knowledge. Those recommendations will place special emphasis on determining whether or not polar operations, as such, create new problems in selection (of personnel), orientation or billet (job) requirements."

It has been suggested that you may have information which will be of value to us in achieving the aims of our project. Specifically, we are interested in printed reports, notes, etc., or personal observations relating to any of the following areas:

1. Problems of selection of personnel for polar regions.

2. Problems related to job performance. Modifications of standard operating procedures, the necessity, if any, of creating new jobs, the effects of environment on performance, etc.

3. Problems of personal adjustment. The effects of isolation on morale, discipline problems likely to arise, personality changes that may occur, leadership factors, and group interaction.

4. Training -- What type of indoctrination is recommended for personnel leaving for polar regions.

5. Problems of physiological adaptation.

It is important to note that we are interested in these problems as they relate to land, sea, and air operations. The staff working on this project have received security clearance through Confidential by the Office of Naval Research, with one member of the staff having clearance through Secret.

We greatly appreciate your cooperation, for it is only through the cooperative pooling of observations, experience, and reports that a project of this scope can succeed.

Sincerely,

Mortimer R. Feinberg, Ph.D.
Project Director

RESTRICTED